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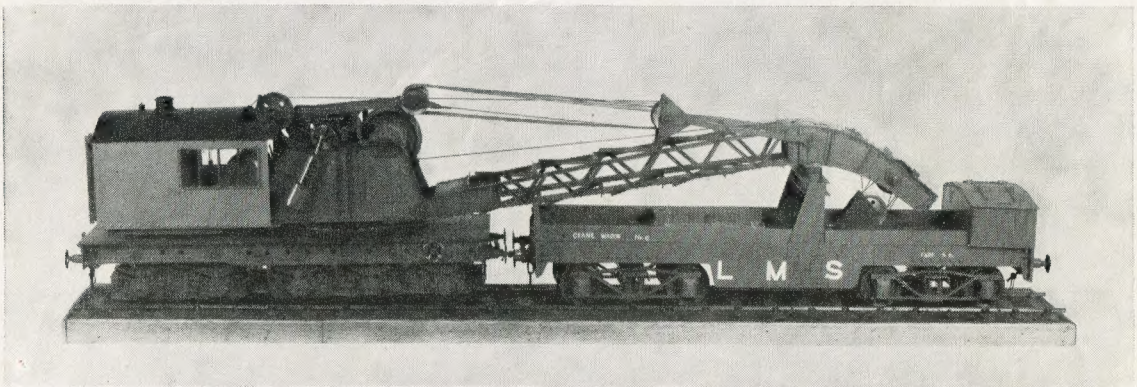

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Volume 140 **Number 3493**

July 19th, 1974

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COVER PICTURE

Avèling & Porter steam tractor No. 8030 of 1913, owned by J. D. Woodward of Papplewick, Notts. Colour photograph by Peter Wilkes.

NEXT ISSUE

An electronic water gauge: Further details of the 1½ in. scale Allchin traction engine.

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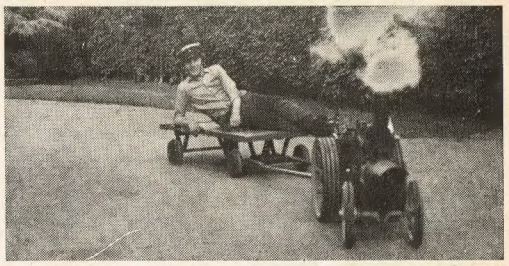

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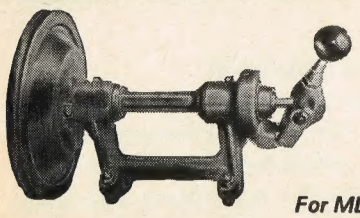

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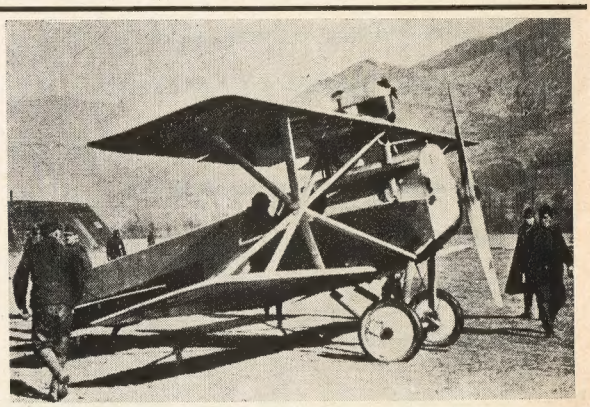

August issue of Scale Models offers a wide choice of topics, including a mammoth report, (in colour too!,) of the Editor's visit to the Shizuoka Hobby Fair in Japan. Many surprises are in store for western modellers when we unravel a host of new items, some of which may come as a surprise to the majority of readers.

Harry Woodman supplies detailed data in the form of superb drawings and photos of the Hansa Brandenburg D-I, a little known WWI fighter, which should stir up the scratchbuilders.

The new Hasegawa Akagi aircraft carrier is reviewed, with colour pictures, and we offer diorama suggestions for marine minded enthusiasts.

New books, die-casts, and kits are reviewed, the latter dealing with such diverse subjects as a V.S. Walrus and the Gotha Go 242 Glider.

The RAF Museum's Mosquito is modelled with special emphasis on 'silver' finishing techniques, there's a special feature on Space Model Kits, and a preview of an amazing car model kit.

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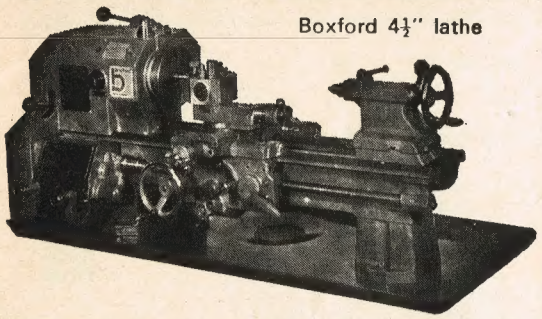

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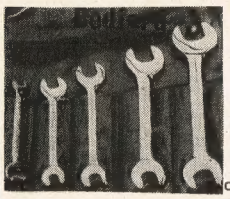

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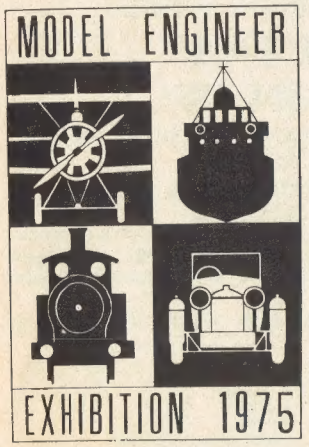

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SMOKE RINGS

A commentary by The Editor

Superheating

My remarks on superheating in the April 19th issue brought me several letters, mainly in support, though a few model locomotive builders favour the "saturated" engine, on the grounds that by leaving out the usual superheater flues, several more ordinary tubes can be got in, with a considerable increase in heating surface.

As to whether superheater flues soon get blocked in service, I very much doubt whether flues of say 1in. outside diameter with a single pair of elements of $\frac{3}{8}$in. o.d. (as for instance in the "Metro" boiler) would ever get blocked, unless the coal was of very inferior quality. Superheater flues should of course always be placed at the top of the tube bank, as the lower they are, the more likely they are to become blocked.

As regards the blocking of the bottom row of ordinary tubes, as mentioned by Mr. J. Cousins in "Postbag", I have been aware of this problem for some time, and in some cases have advised builders to leave the bottom row (usually three tubes) out altogether. Perhaps a better solution would be to use rather larger diameter tubes for the bottom row, as suggested by Mr. H. H. Nicholls in this issue. Even so, they should be arranged at least 3/16in. clear of the bottom of the barrel at the firebox end, with a rise of 3/32in. to 3/16in. (according to the size of the boiler) towards the smokebox end.

Model Engineer Exhibition

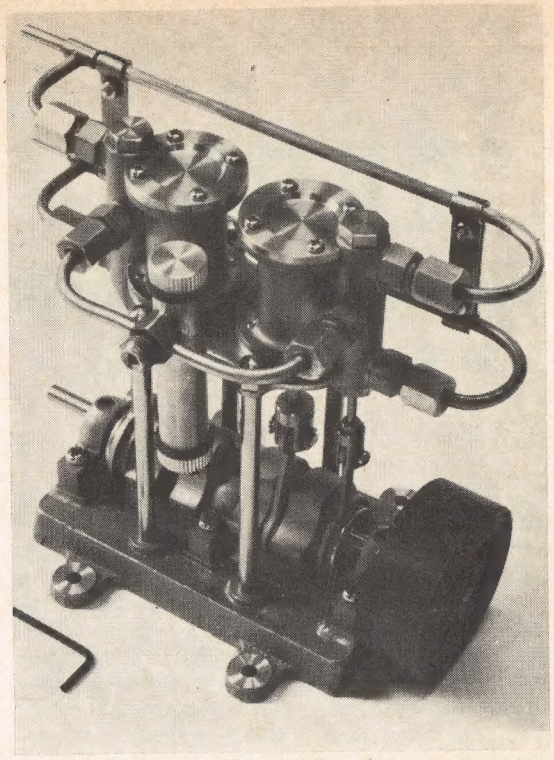
The Model Engineer Exhibition will again be held at the Seymour Hall, Marble Arch, W.1, the opening dates being 31st December to 11th January inclusive. Entry forms are now available, and although there are five months to go in which to finish models under construction, early applications are much appreciated.

At this exhibition, hot air engines will be judged in Class K, which in the past has been reserved for internal combustion engines (petrol or diesel). Previously, they have been allocated to Class J.

As we had a very large entry of "military and war-gaming" models in the Junior class (S), these will now be divided into model engineering types of entries and military entries, which will make life easier for the judges!

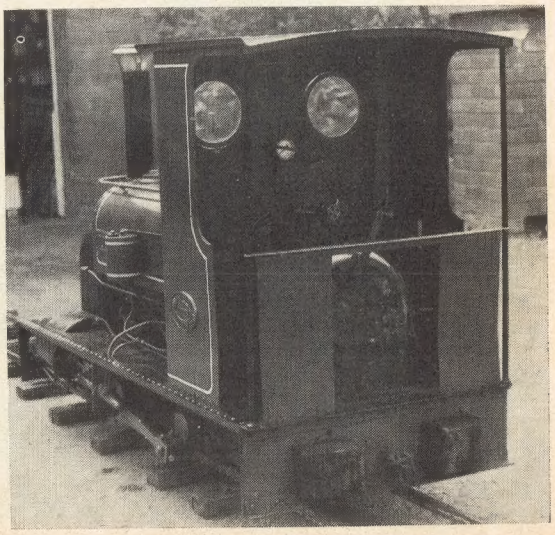
At the 1974 Exhibition, we had a very poor entry for the Duke of Edinburgh Trophy, which was rather surprising, as there must be many fine models around that are still eligible. Previous winners of Silver Medals, or any of the well-known individual Trophies (Aveling-Barford, Bowyer-Lowe, Bradbury Winter, Crebbin, H. V. Evans, Maze, and Maskelyne) are eligible for the Duke of Edinburgh section.

May I also remind readers that unfinished models are welcome in our "Loan" section, or for that matter finished models whose owners do not wish to compete for any of the Trophies.



A twin-cylinder model marine engine now being manufactured in Japan by the Saito Engineering Co.

A 7¼ in. gauge model of Hunslet 0-4-0 S.T. of 1922 built by R. H. Marsh and owned by K. Blackham. (See article by C. R. Weaver in this issue.)



QUORN

TOOL AND CUTTER GRINDER

by D. H. Chaddock, C.B.E.

Part XIV *From page 633*

FIG. 70 SHOWS a larger side-and-face cutter being ground in exactly the same manner, except that here the tooth rest is being used to index the teeth and it is being used inverted. This of course is quite easily done by fitting the entire tooth rest assembly to the vertical column above the wheel-head assembly instead of below it. Tooth clearance is again given by tilting the work-head but this time, because the cutter teeth are pointing upwards instead of downwards, clockwise instead of anti-clockwise. This particular cutter is a right and left handed one and is deliberately included in this series as an example of more sophisticated cutter grinding. The face teeth for example cannot all be ground at a single setting. The machine must first be set up to grind say every alternate left-handed tooth. When they are finished it must be reset to grind the intermediate right-handed teeth. Because the tooth height setting will be lost in the process the height of the second set of teeth must be checked with a dial test indicator. Alternatively a witness may be ground on all teeth by cylindrical grinding and the two sets of teeth ground until the witness disappears.

A variation of the "first position' 'is shown in Fig. 71 in which an angle cutter is being ground. It is accomplished very easily by turning the rotating base to the required angle and locking it in position. Because the cutter diameter varies from tip to base the "second position" of grinding cannot be used and the limitations of a slightly curved clearance angle given by the "FIRST position" must be accepted, otherwise the method of setting is the same as for a parallel sided cutter. This photograph also illustrates the use of the degree scale for indexing. Since the cutter has ten teeth for which there is no circle of holes in the division plate it is moved on 36 deg. on the degree scale each time to bring the next tooth to the grinding position.

Having mastered the intricacies of plain cutter grinding, which after all are not so intricate, we turn our attention to grinding ball nose and radiused cutters. Before this can be undertaken it is first necessary to set the machine so that the axes of the rotating base and of the work-head are exactly coincident. This is accomplished by the use of the long setting pin already detailed in Fig. 65 which fits in the hole in the rotating base and another pin which is held in a collet chuck in the work-head. The faces of both pins are brought into contact as in Fig. 72 and the position of the work-head locked. As a check the longer pin can be retracted, both pins turned through 180 deg. and re-engaged. This is a very sensitive test because if there is any error it will be doubled and the pins will either jam or have clearance between them. You can either split the difference if it is not too great, say less than 0.0015 in. when tested by a feeler gauge of this thickness or look for the error elsewhere which may be in the straightness of the

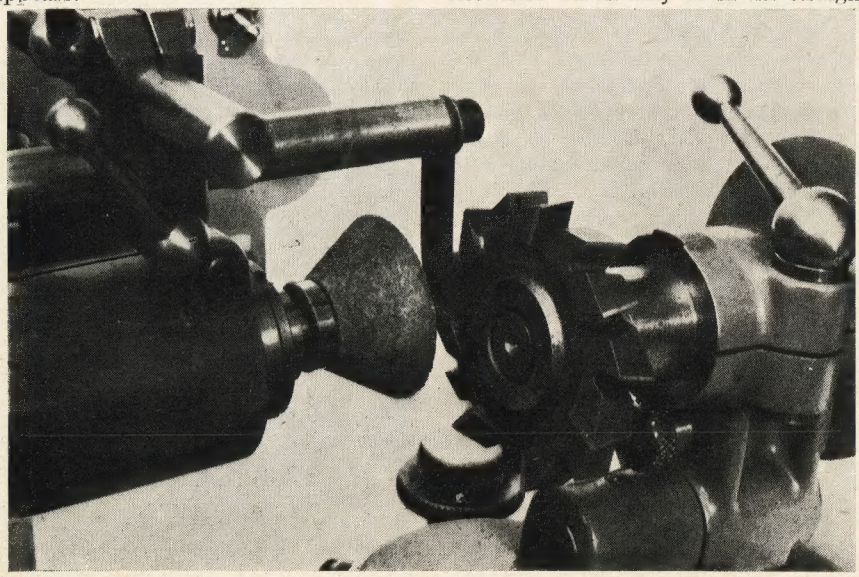
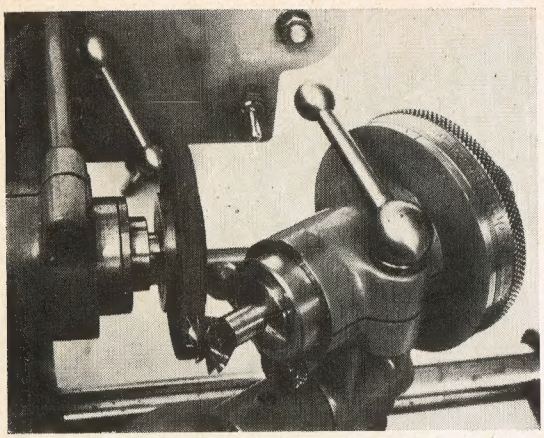


Fig. 70. Grinding the side teeth of a side-and-face cutter. The tooth rest is inverted for this operation.



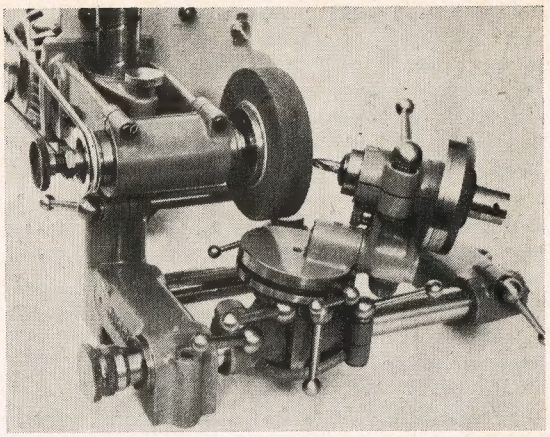
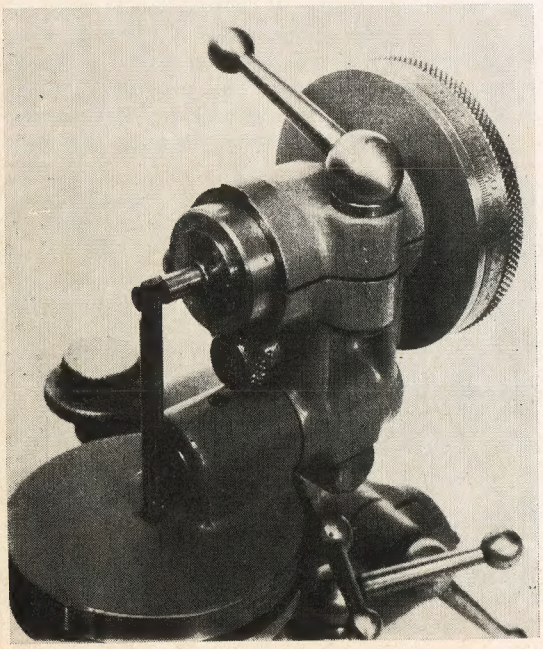


Fig. 71: Angle cutter grinding.
Right: Fig. 73. Grinding a ball-nose cutter.

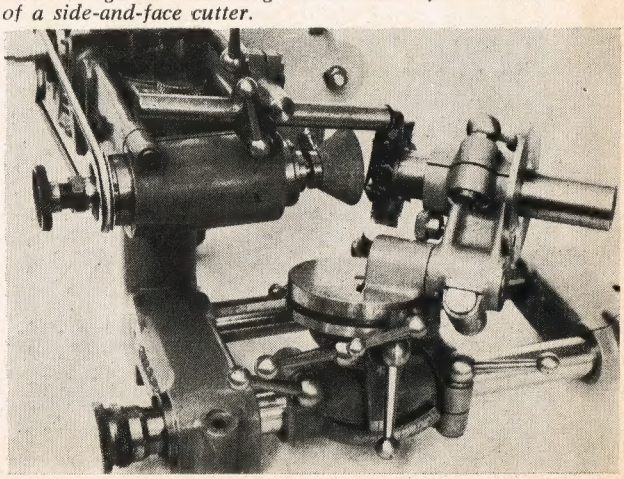
pins, eccentricity in the collet chuck or error in boring the hole in the rotating base. Once set, the work-head must not be moved again, but the setting pins can be removed and the cutter to be ground held in a suitable chuck as in Fig. 73. Clearance both front and side is provided by setting the tilting bracket to the required angle.

The rotating base is left free to turn but the stops are set at 0 deg. and 90 deg. to prevent an over-shoot from damaging the side teeth of the cutter. Finally the cutter is slid forward in its collet until both tip and flank make equal contact with the grinding wheel as the rotating base is rocked through 90 deg. To accomplish this easily really needs another slide on the machine or the use of a setting micrometer which has been designed but not yet made, but with care it can be done without these aids. The actual grinding is quite straight-forward and once one side of the ball end has been ground it is only necessary to index the cutter through 180 deg. to grind the other. Once the primary clearance has been ground on both teeth it is necessary to grind a secondary clearance at a much larger angle, 25 deg. to 30 deg., to prevent the heels of the teeth rubbing against the work. To do this it is only necessary to increase the angle of the tilting bracket but first check that the primary clearance will not be ground out at any point and gradually reduce the width of the land until it is 0.010 in. to 0.015 in. wide depending on the size of the cutter.

The width of land is best judged by eye, so familiarise yourself with professionally-ground cutters, or look at the edge of a feeler gauge. Incidentally, it is customary to grind a primary



Left: Fig. 72. Aligning the axes by the use of setting pins.
Below: Fig. 74. Radiusing the corners of the teeth of a side-and-face cutter.



and secondary clearance on all cutters except fine tooth ones such as circular saws where the width of the primary clearance land is, or should be, very narrow anyway.

The "pons asinorum" of all cutter grinding, shunned by the professional as much as by the amateur, is radiusing the corners of a side and face mill or the ends of the teeth of an end or shell mill. Consequently they are left dead sharp and are an open invitation to the initiation of fatigue cracks in the sharp corners that they leave in the work. But the difference in the appearance of say a locomotive connecting or coupling rod which has been fluted with a cutter with radiused corners and one done with a cutter which has been left with a sharp corner is immediately obvious.

Radiusing the corners of a side and face mill is shown in Fig. 74. To bring the corner of the cutter, not its axis as in grinding a ball nose, into line with the axis of the rotating base, the centre line of the cutter must be displaced by swinging the work-head to one side. The long setting pin must be used, first to align both the side and face of the tooth with the axis and then to advance them beyond this position by an amount equal to the radius to be ground. Again it really needs a setting micrometer, but by checking against the face of the wheel which, used in conjunction with the front bar micrometer, really comes to the same thing, the job can be done. A special tooth rest blade, made from a broken hacksaw, with a narrow point, is being used here in the inverted position, because there is really very little room and the corner of the cutter only travels a very short distance in radius of a small circle. Clearance is provided as before by setting the tilting bracket and the stops on the rotating base, which is of course left free, are set to prevent overrun of the cut. Radiusing is not easy, but if you can produce a cutter in which the radii are all equal and perfectly blended with the sides and faces of the teeth you can take it with pride to the next club meeting and apply for full membership of The Royal and Ancient Order of Axe and Cutter Grinders!

Grinding and making very small cutters down to 1/16in. dia. or less presents special problems. Engraving type cutters, which are really "D" bits backed off on the circular body so that they cut on the side as well as the end, are easy to make. They can be parallel or tapered and have square, radiused or ball nose ends. They cut quite freely in soft materials, but only having a single cutting edge are slower and weaker than a slot drill or end mill of the same size.

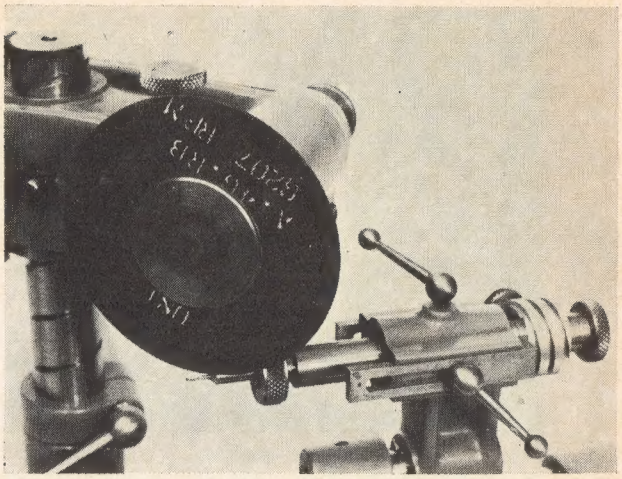


Fig. 75. Fluting a very small end mill.

Grinding from the solid in hardened high speed steel is shown in Fig. 75. The cutter blank, which may be an ordinary round tool bit, is first reduced to diameter by ordinary cylindrical grinding using a plain disc wheel and rotating the work by hand. The spiral flutes are ground in by using the traversing mandrel and a suitable guide hob. The wheel in use here is an ordinary abrasive cut-off wheel 4in. dia. purchased from the local D.I.Y. shop. Its use for cutter grinding is unconventional but dressed true it cuts very well and holds a good corner. The wheel-head is of course rotated to match the spiral angle of the cutter, but the actual setting of the wheel in relation to the cutter is difficult to describe in words. The plane of the wheel is offset in relation to the axis of the cutter so that one corner is deeper than the other. This produces a sufficiently deep cutting edge without unduly weakening the shank of the cutter. Perhaps the best

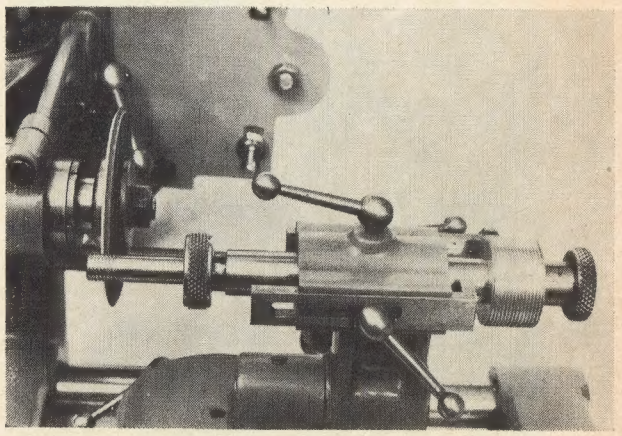


Fig. 76. Thread grinding.

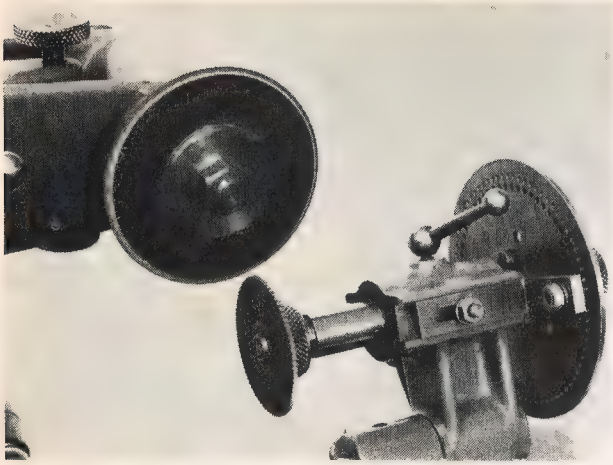
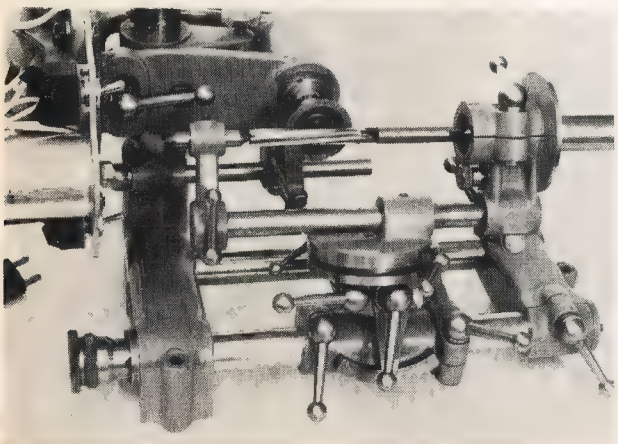


Fig. 77. Gulleting a fine tooth circular saw.

thing to do is carefully to study a commercially-made cutter and then to try to reproduce the method of grinding. Once the setting is correct grinding the cutter is easy enough and it pays to make several at the same time—their lives are not all that long. By placing the wheel-head in the "first position" but without moving the cutter or the guide hob in the traversing mandrel the teeth of the cutter can be backed off both on the sides and ends in just the same way as the larger cutters. The adjustments are of course delicate, but by moving the guide pin bar and the front bar in conjunction with one another it will be found that the angular position of the cutter can be controlled with great precision.

Another use of the traversing mandrel is to grind screw threads in hardened material. In Fig. 76 a plain shank cutter is having a $\frac{3}{8}$in. by 20 t.p.i. thread ground upon it. Here I must apologise for a mis-statement on page 292 in which I implied that "Clare" cutters have screwed shanks. They have not but the bayonet type lock that this particular type of cutter uses can be ground from the solid by the QUORN, but not of course with the traversing mandrel. To return however to Fig. 76 the wheel is first dressed by one of the methods shown in Figs. 60 or 61 to an included angle of 55 deg. and a simple hob with a plain 20 t.p.i. thread used to guide the work. The tilting head is set to the spiral angle of the thread, in this case a shade under $2\frac{1}{2}$ deg. To save excessive wear on the fine edge of the wheel the thread should be brought to nearly full depth in a single pass, rather than by a succession of light passes as one would employ on a lathe. Quite apart from tool making the facility to grind threads could be a very useful one in general model engineering in for example making high tensile studs from material too hard to be cut with a die.

Fig. 78. Reamer grinding.



Another use of the traversing mandrel is shown in Fig. 77 in which a fine tooth circular saw is being re-gulleted. This is an important part of reconditioning because although a saw is normally only sharpened at the tips of the teeth, with clearance of course, each sharpening reduces the size of the gullet. Comes a time then when the gullet is no longer big enough to contain the chip produced by the passage of the tooth through the thickness of the metal being cut and the chip, which has nowhere else to go, jams the saw in the cut.

The wheel is the same as that used in Fig. 76 but here re-dressed to an included angle of 60 deg. In dressing angle wheels it is not good practice to dress the face of the wheel only and to leave the side to produce the other side of the included angle. For one thing such a wheel is not easy to redress and for another the wear on the two faces will not be equal. The included angle, whatever it is, should be more or less equally divided between the two faces so that each does an equal amount of work. Such a wheel can nevertheless be used to grind radial or even undercut teeth by offsetting it until one face is radial to the axis of the cutter—a point easily checked by a setting pin and straight edge.

In gulleting a cutter or in grinding the radial teeth of a form cutter a tooth rest cannot be used because it cannot engage the tooth being ground. Attempts to index the cutter by engaging the tooth rest with another tooth are not likely to be successful because cumulative pitch errors will arise, particularly with cutters with large numbers of teeth. A positive and independent

means of dividing is required and in Fig. 77 the same brass plate that was used for the engraving is being used again with a new ring of holes in it, but change wheels, regular division plates, in fact anything with the right number of divisions can be used if it is mounted on a suitable bush to fit the spindle. Even a spring loaded index pin is not necessary, just unlock the spindle, slide it back and re-engage the next hole or tooth. Grinding fine tooth cutters is a pleasant job for a quiet evening when one does not feel like any real work!

The machine performs an entirely different role when the long bar bed is in use and the work is ground between centres as in Fig. 78. As far as the wheel head and the tooth rest are concerned the setting is exactly the same as for the "first and second" positions which have already been described in detail and either may be used. But just as in the case of the top-slide of a lathe, it is not sufficient to rely entirely upon the setting of a degree scale to ensure parallelism of long work. A further consideration is that as the tailstock has no means of locating it, it must, in any circumstances be set parallel. It is recommended therefore that before grinding, the centres be set true by mounting a parallel mandrel between them and using a dial test indicator. Once set, the tailstock should not be moved but work of various lengths can be placed between, and removed from, the centres by using the mandrel head, which is always parallel to the bed, as a working tailstock.

Of course it must be realised from the outset that a standard size reamer cannot be resharpened AND hold its nominal diameter. It is a moot point whether it is better to have a blunt $\frac{1}{2}$in. reamer which does not cut, or a sharp reamer which is 0.002in. undersize. Since most reamers are mainly used to produce a round and parallel hole to which a turned part is subsequently fitted the latter is probably the better strategy and come the metric system maybe we shall be able to regrind our worn fractional inch reamers to the next smallest metric size!

Just as it is easier to turn taper than parallel, so by setting the rotating base to an appropriate angle, taper reamers can be ground and the lead ground on parallel ones. Grinding between centres can also of course be applied to any tool or cutter which has good centres at both ends as an alternative to chuck or arbor mounting.

Until the advent of the QUORN, small taps like small cutters were seldom sharpened during the course of their working lives and finish up blunt or broken. In Fig. 79 a tap is being sharpened along the length of its flutes. This

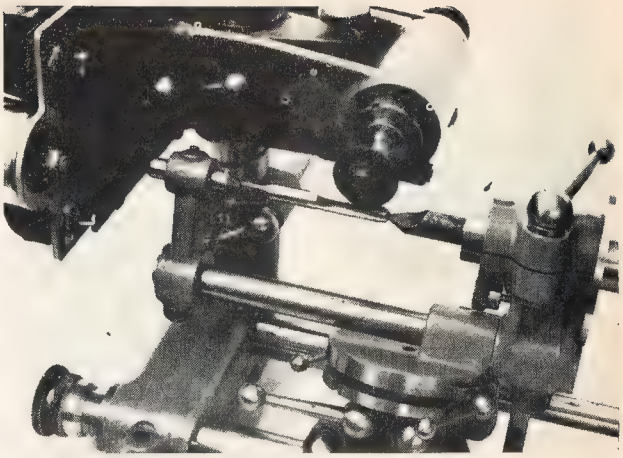
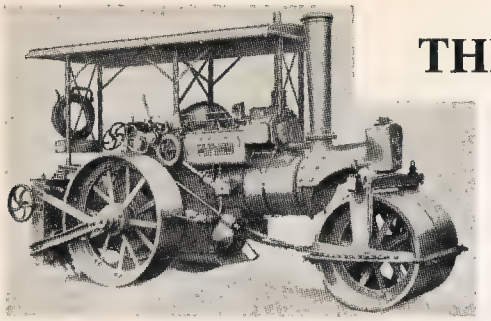


Fig. 79. Sharpening a tap.

method of sharpening, which can also be applied to reamers if they are not too badly worn, does not reduce the effective diameter, since they have no clearance, and can be repeated until the lands are too thin to withstand the force of cutting. Indeed a tap cuts more freely if the lands are relatively narrow and some new but not too well made taps, especially fine pitch ones, would be the better for a bit of metal off the lands before ever they were used. Taps and reamers that are too small to have a female centre in them are nearly always left with male centres at the ends and can therefore be mounted between female centres as in Fig. 79. Here a small plain disc wheel with the edge dressed to a semicircular radius, is being used to grind the flute and to provide clearance at the run-out over the half centre at the right hand end. Because the flute is deep and accurate indexing is not essential, it is sufficient to keep the leading edge of the tap up against the face of the wheel by finger pressure alone as the work is traversed back and forth.

After all the intricacies of cutter grinding, tool grinding is a kiddies' practice job. The first operation is to align the square hole in the tool holder with the rest of the machine. So with the long setting pin in the hole in the rotating base and a tool in the holder slacken off both the spindle and bracket clamping bolts and bring the base of the tool firmly in contact with the flat on the setting pin as in Fig. 79. Lock both clamps, free the index ring and set it to any one of its four zeroes and relock. Free the spindle lock, remove the setting pin and you are ready to grind any conceivable angle without further setting, each face of the tool being represented of course by one of the four quadrants into which the degree scale has been divided.

To be continued



THE "M.E." STEAM ROLLER

An Aveling & Porter Compound

Built and described by John Haining

Part III

From page 620

READERS WHO remember the series of articles Colin Tyler and I wrote for "M.E." some six years ago, describing the construction of our Fowler compound ploughing engine, will no doubt remember that we recommended two methods of attaching these extension pieces: the first by means of a dovetail or scarf joint, the second by using a butt strap behind the joint.

The latter is by far the easier method particularly if the butt strap is held in place by four copper rivets 3/32 in. dia. prior to silver soldering or brazing along the joint. Care must be taken, if this latter method is used, that the rivets do not coincide with stay positions.

After the foregoing operations are completed, the longitudinal seam should be brazed or silver soldered; here again my own personal preference is for a butt strap to run the length of the seam inside the shell, secured in place initially by means of eight copper rivets, with care taken to ensure that the butt strap is clear of the lower two tubes.

At this stage the three bosses — pump boss on R.H. side, check valve on L.H. side, and steam turret boss on boiler centre-line above the firebox may be silver soldered in position — some readers may prefer deferring this task until the boiler is nearing completion, when all bosses may be dealt with at the same time. Bosses should be drilled and tapped either before they are secured in position or afterwards while the boiler barrel is still open and swarf can be easily removed.

To complete the first stage of construction, braze or silver solder the throatplate in place, supported as shown on the boiler drawings by the lower curve of the barrel, at the top edge of the plate. Whilst the job is still hot, the steering saddle or footstep bracket should be secured in position beneath the barrel. The boiler barrel should now be complete, with wrapper extensions and throatplate brazed or silver-soldered in position, awaiting the fitting of the firebox and remaining items, the major ones being the firebox and tube assembly, which should be tackled next. Assemble and braze up the firebox, with firehole ring inserted and slightly peened over where it fits through the plate, then tackle the crown stays which if difficult to keep in position for brazing may be attached with a couple of 3/32 in. rivets to the crown plate. Insert the tubes into the tubeplate, and line up with the smokebox tubeplate which should have been flanged and trimmed off, before turning to a tight fit in the boiler barrel, with the fourteen 7/16 in. dia. holes for the tubes reamed and very lightly countersunk on the outside ready for the silver solder to run easily around the tubes when we come to that stage of the proceedings.

Silver solder the tubes into the firebox tubeplate, then remove the front tubeplate from the end of the tubes, and insert the firebox and tube assembly into the boiler, securing the firebox tubeplate to the throatplate with two 3/32 in. copper rivets through both plates and the front length of foundation ring.

The crown stays are not attached to the outer wrapper plate, and this saves us a bit of work at this stage, so the next operation is to insert the smokebox tubeplate into the barrel, expand the tubes into their holes and silver solder the flange of the tubeplate to the barrel, and the tubes into the tubeplate.

The backhead should now be ready for assembly having been flanged up and trimmed to be a tight fit in the wrapper plate, with the holes for the firehole ring and water gauge bushes already drilled.

Insert the backhead into the wrapper and over the firehole ring spigot which should be riveted over the surrounding plate, then insert the remaining three lengths of foundation ring, securing each length in place with a couple of 3/32 in. rivets, and making sure that the foundation ring fits tightly into the spaces between firebox and outer plates, and lastly silver solder or braze the backhead into the wrapper, finishing off with the water gauge bushes and any others not yet dealt with.

This boiler has been designed without longi-

tudinal stays, as the tubes adequately support the front tubeplate, and the backhead is amply supported through firehole ring and stays, so the next step is to mark out, drill, and tap all the stay holes.

The side stays number 20 per side screwed No. 2 BA through outer and inner wrapper plates with five hollow stays each side screwed $\frac{3}{8}$ in. × 40 T.P.I. externally and drilled through and tapped internally No. 2 BA as per sketch.

The backhead has six and throatplate six No. 2 BA screwed stays; like the No. 2 BA side stays these should be a reasonably tight fit when screwed fully home, and riveted over on the outside, nutted on the inside, both ends being silver soldered over head and nut. The bigger hollow stays should be screwed home tightly before silver soldering and squaring up the outer ends to allow the hornplates to sit squarely when secured by No. 2 BA hexagon-head setscrews screwed into the hollow stay.

And now to revert to the subject of the cylinder mounting saddle, which I mentioned earlier.

Those readers who have followed my drawing exactly will have drilled and tapped the barrel and backing plate for No. 4 BA setscrews securing the saddle to the boiler top, but those who decided to avoid using the backing plate will have to drill the barrel for No. 4 BA setscrews and hexagonal nuts, and this must be done, of course, before the front tubeplate is brazed in position — in fact it is best carried out when the shell only is completed. The nuts should be lightly anointed with Loctite before tightening, and before marking off the holes in the boiler from the holes in the saddle, do make absolutely sure that the saddle is positioned square with the centre-line of the boiler. The saddle on the full sized engine is riveted to the boiler shell, but there is no point in turning down hexagonal head bolts or filling in the slot on round head screws to simulate round head rivets as these are *not* visible when the boiler lagging is in position. One of my photographs shows the saddle, with the heads of the bolts on the outside, nuts on the inside of the shell.

As with our ploughing engine boiler, Johnson Matthey's B6 or C4 alloy can be recommended for the main external joints, while Easy-flo No. 2 cannot be bettered for fixing the tubes and the various bushes.

Don't forget the thorough pickling followed by washing in cold, clean water to complete the job before setting up the boiler for testing.

Prior to testing, screw blanking plugs into all the bushes except the one for the check valve, to which fitting is connected the hydraulic line from the test pump. Plug the steam orifice in the cylinder saddle, with a tight fitting tapered hardwood plug. Kept in position with a "Jubilee" or similar clip, fitting around barrel and saddle — incidentally when fitting the saddle to the boiler use plenty of "Stag" or similar jointing compound to allow this to set and harden before filling the boiler with water.

Test to 200 P.S.I. — pointless to go any further — and follow this, if no leaks or weeps appear, with a steam test to 25 per cent above working pressure, after fitting the boiler with a suitable safety valve set to blow-off fully at this figure.

Front roller fork

In accordance with usual steam roller practice, the front rolls are mounted in a fork terminating in a central pin passing vertically up through the front portion of a cast saddle which is, in turn, bolted rigidly to the short smokebox as shown in my sketches.

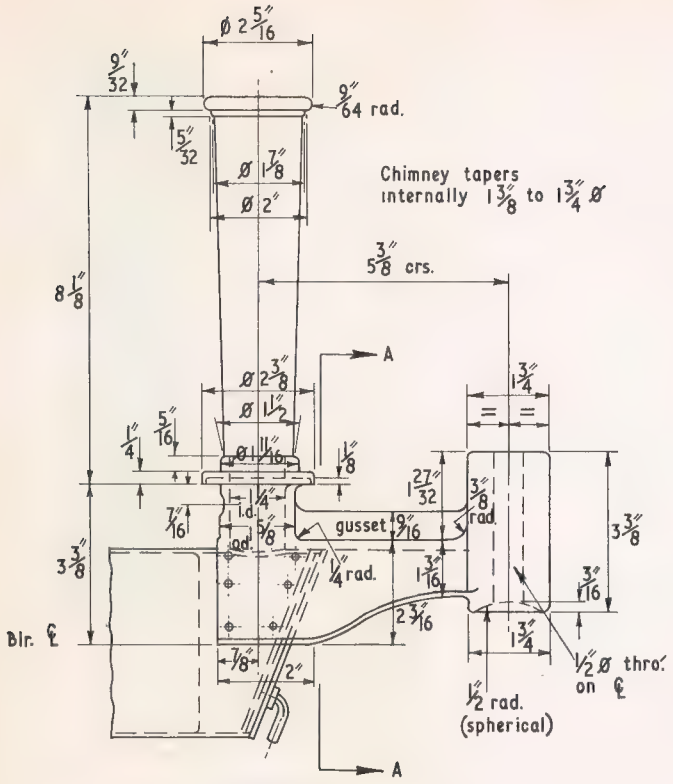
To accommodate irregularities in the road surface, the hole in the saddle is shaped to allow the fork pin to move a few degrees from the vertical in a sideways direction, but not in a fore and aft line, the fork pin being retained in the saddle steering head by a large pin shaped washer.

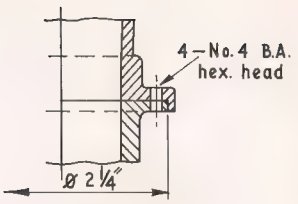
The lower ends of the massive roller fork each terminate in a boss housing the roller axle and an outer curved facing to which is bolted the curved chain shoe, shaped to form an anchor and guide for the steering chains, running from the steerage worm shaft to each side of the front rolls. Extending from the chain shoes, both behind and in front of the rolls, are two lengths of angle which act as scrapers, cleaning the roll surface and any surface material adhering to them.

A simple lamp bracket bolted to the top of each leg of the fork completes the actual steerage assembly as far as the front end is concerned.

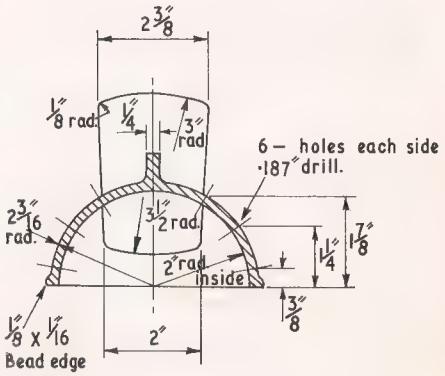
The cast saddle itself is a fairly heavy item, as it obviously needs to be, but this did not prevent the very occasional breakage between chimney base and fore-end, resulting in the front of a roller dropping down onto the boiler front, in a most undignified "kneeling" position!

The type A.D. roller is shown on the Aveling works General Arrangement drawing as having the top surface of the saddle running straight to the steering head i.e. parallel to the boiler centre-line, while catalogue illustrations depict the top surface and centre gusset curving up at a slight angle to join the head, but I have followed the form shown on the works drawing in my own

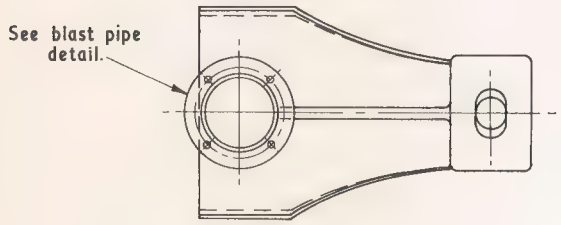




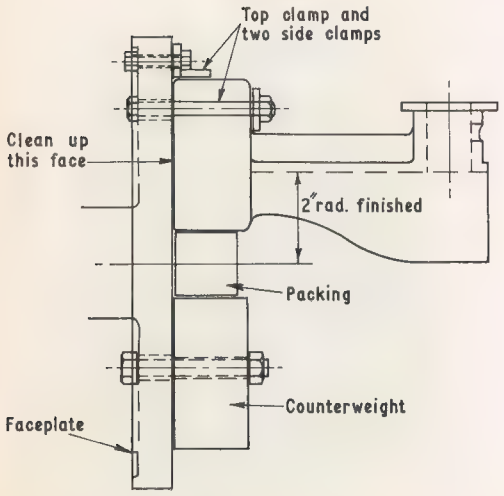
Enlarged detail of chimney flange spigot.



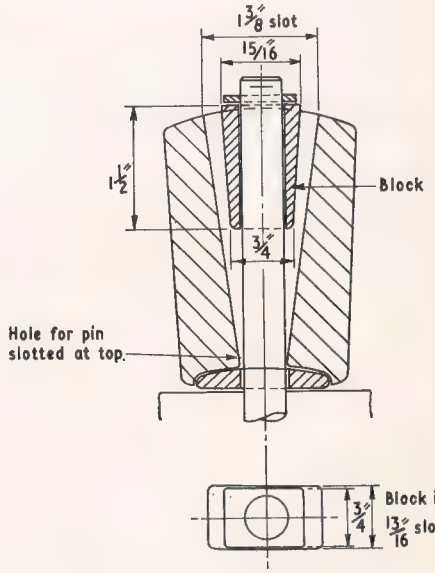
SECTION A A



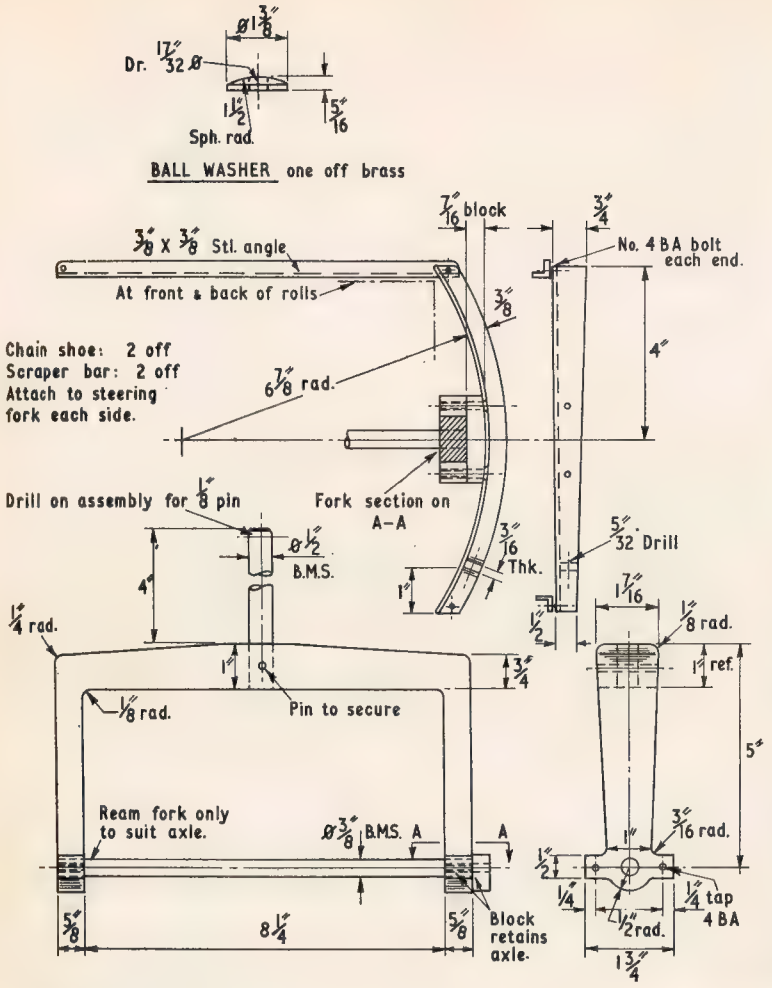
STEERING SADDLE AND CHIMNEY



SADDLE ON FACEPLATE



SECTION THROUGH STEERING HEAD SHOWING SLOT AND BLOCK



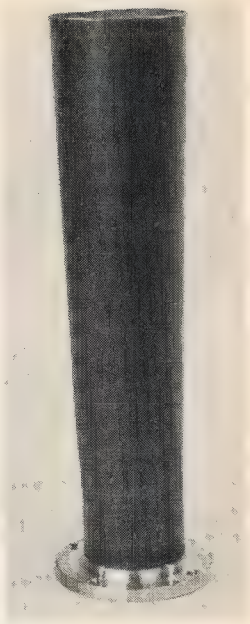
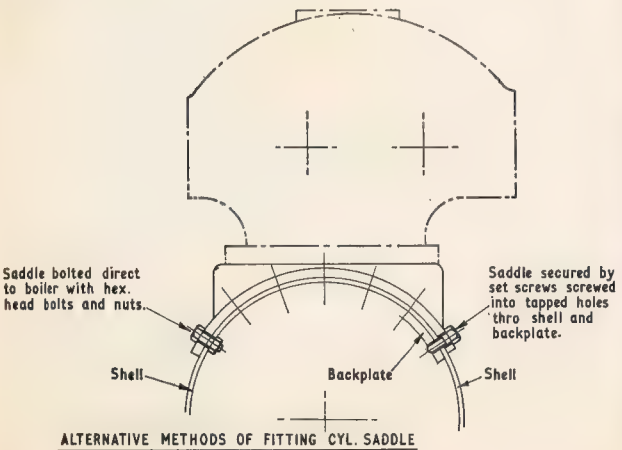
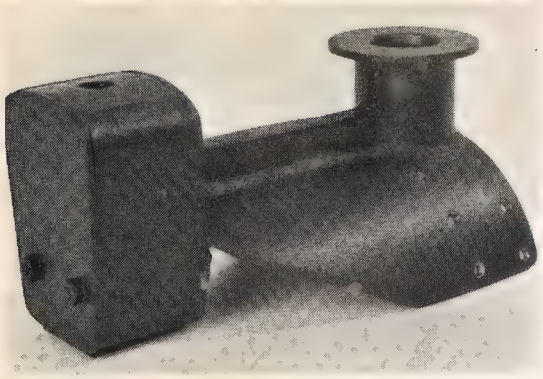


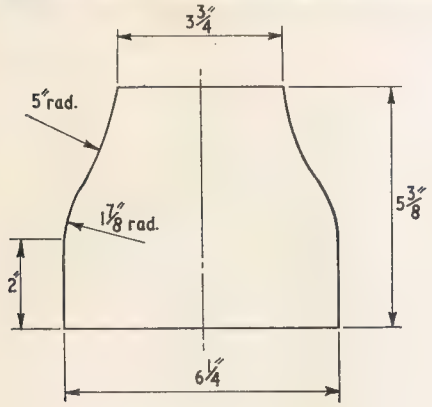
Fig. 1. The chimney under construction.

Fig. 2. (Right-hand page.) The steering head and saddle.

Fig. 3. (Below.) Another view of the steering head.


Saddle bolted direct to boiler with hex. head bolts and nuts.
Saddle secured by set screws screwed into tapped holes thro shell and backplate.
Shell
Backplate
Shell
ALTERNATIVE METHODS OF FITTING CYL. SADDLE





TEMPLATE FOR STEEL SADDLE

rendering of the saddle. My reasons for doing this are twofold; firstly to simplify the pattern and secondly to make fabrication of the saddle easier if any reader decides to use this alternative method of construction.

The saddle casting incorporates the chimney base, and the two-inch scale version follows full size practice in as much as both saddle and steerage fork are castings, too, but as an alternative have also been produced as welded steel fabrications.

Dealing with the castings first, the saddle will require three machining operations, first the inside radius must be cleaned up and machined to sit snugly on the outside diameter of the smokebox, next, the chimney base flange requires machining, and thirdly the front steerage head must be drilled to take the forkpin, exactly on the vertical centreline of the saddle and parallel to the chimney centre line in the other plane. After several false starts, the saddle was securely mounted on a faceplate as shown in the sketch and successfully machined internally, but the ideal way is to machine a pair together to obtain smoother turning and balance the job.

Turning the saddle casting through 90 deg. and reclamping allows the chimney base flange to be dealt with, and the bore to be cleaned up to 1¼in. diameter. This latter operation then makes possible the mounting of the whole saddle upside-down on a flanged spiogt on the drilling machine table for the steerage head to be pilot drilled 5/16in. dia. followed by the ½in. drill. The necessary transverse elongation of the finished hole, running from the bottom to top, to allow fork tilting movement, was carried out with a round file—admittedly a laborious method which would have been better done as a milling operation with the saddle held in a clamp or fixture at a slight angle, changing the angle to allow each side of the hole to be extended. The spherical recess on the underside receives the spherical ball washer between fork and head. The fabricated saddle is made up of a short length of four-inch bore steel pipe 3/16in. thick, flame-cut to follow the outline of the cast saddle—a cardboard template is useful here, in marking out the surface of the steel pipe.

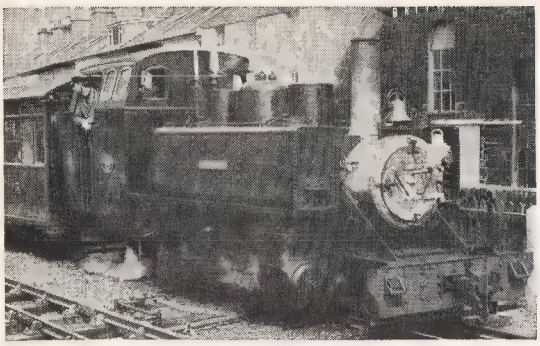
A 3⅜ in. length of three inch square b.m.s. bar, cut through two ways leaving a small allowance for finish machining, forms the steerage head, while the chimney base and flange are turned and bored from an offcut length of 2½in. dia. b.m.s. bar, a short length of ¾ × ¼in. b.m.s. flat reduced to 9/16in. forming the gusset or web running from steerage head to chimney base. Before welding, scribe a centre line down the outside of the saddle forward from steel pipe, and carefully locate the steering head and chimney on this line—incidently the 1¼in. dia. hole in the saddle to coincide with chimney base should have been drilled first in order that the base may be bolted to the saddle in readiness for welding together.

Clamp the steerage head to the saddle and weld up the assembly, following up with the ¼in. thick gusset, dead on centre-line between head and base of chimney. One omission apparent on the plain fabricated saddle is the slight lip running externally along both bottom edges of the saddle radius, merging with the steerage head at the front end.

This may be reproduced by sweating a 16 SWG strip of copper along the edge of the fabrication, or by running a line of weld, using a light rod, along the edge and cleaning up with grinding wheel and file to simulate the smooth cast tip of the full size saddle.

My sketch of the cardboard template for cutting the saddle tube allows rather a lot of material at the front end, where the saddle joins the block of the steerage head.

To be continued



MOUNTAINEER

A narrow-gauge 2-6-2 tank locomotive for 3½ in gauge

by Don Young

From page 639

To EACH of the rear division plates is attached a gauze barrier, so that the injectors obtain a clean supply of feed water. This gauze must be cut to the full dimensions of the shell, to leave no gaps for debris to pass, being attached to the division plate with a few tacks of Comsol.

Slide the after division plate into the shell and carefully position. Mark on the position of the rivet holes, centre popping very lightly, then drill through in about six strategic positions, fitting 10BA bolts as a temporary measure as you proceed. An alternative method of fixing is by those little Avdel clamps used so extensively in the aircraft industry. Drill the remaining holes, all being No. 51.

Remove the division plate from the shell and dress off all those burrs produced when drilling; this is important to obtain a leak-free joint, otherwise you may well have to sweat over all the rivets, a most tedious process. Re-assemble and refit the 10BA bolts, or the clamps, and we can begin riveting up. There is no choice of rivet for this application as far as I am concerned, simply use 1/16 in. dia. × ¼ in. long copper snapheads. Bitter experience has been that brass rivets are too hard when being driven down onto softish brass or copper sheet. Support the head of the rivet on the inside of the tank with a stout bar, say 1 in. square, as the dolly which is gripped firmly in the bench vice, and attack the protruding shank first with the set and then with one half of the rivet snaps. It does not matter if the rivet head inside the tank distorts, nobody will see it once the tank is complete, oh, and you will certainly have to slightly shorten the rivet shank to get a perfect head on the outside of the tank, experience will show the length required as you proceed.

The next item required is the nameplate, which may be a photoetching, or a brass casting requiring only the use of files and emery cloth to exhibit its full glory. A kind Canadian reader, Robie Butterworth of Rockland, Ontario, sent me a sample of polishing material which is excellent for this purpose. Robie's description of the polisher was "green plasticised horse hair", which is exactly what it looks like; very handy in service too!

If you decide to attach each nameplate with a couple of 8BA countersunk screws, this must be dealt with immediately. Position the screws clear of the lettering, this will have to be done to place, hold against the tanks and drill through No. 44. Some years ago now yours truly invested in a bag of Mr. Whiston's "assorted nuts". Steel and brass ones, not the Christmas variety, though the latter would have seemed to be more useful at the time! They were relegated to a separate tin and stored in the deep confines of one of the bench drawers, there to languish evermore, or so I thought. It was months later that I began to appreciate just how valuable an assortment they were. On my Isle of Wight locomotive were many 8BA tapped holes into 16 s.w.g. brass sheet, on the running board, cab, and bunker. Repeated assembly caused some of these delicate tapped holes to strip, an all too common occurance, and one that would normally be solved by tapping out to the next size, in this case 6BA, and fitting larger screws. But on the running boards I had used 8BA roundhead screws, with slots filled in afterwards, to represent snaphead rivets, they were not the full roundhead and gave a smashing finish. The answer to the thread stripping was found in the much maligned tin, in the form of hank bushes and clinch nuts. They will be found equally useful to attach the fitments to our side tanks, where the use of ordinary nuts is prohibited and tapped holes in the shell will simply be a nuisance. At least I can repay this long outstanding debt of gratitude to Mr. Whiston.

Drill the tanks to a neat fit for the spigot on the hank bush, push it home and splay out the spigot into the face of the tank. Some bushes need a light countersink on the outer surface in order to fit flush, this you can evaluate by using a sample first in an odd scrap of 16 s.w.g. brass or copper. That takes care of the nameplate, now

the forward division plate can be fitted, exactly as its partner, but minus the gauze.

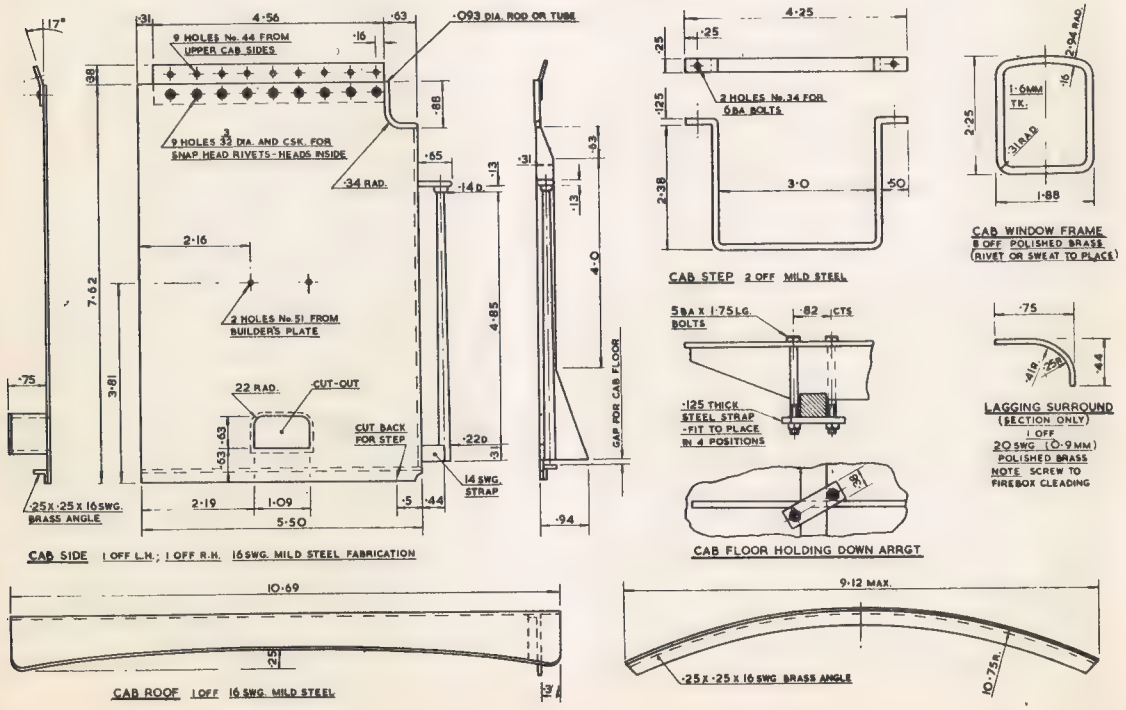
Whilst we still have easy access to the inside of the tank, let us make up and temporarily erect the hand pumps. There is one in each tank, then there can be no chance of going to the wrong side of the engine in an emergency! These hand pumps are my standard pattern and have been described several times in the past few years, so we can dispense with notes here and simply erect them inside the tanks. The delivery pipe inside the tank will cause no problems at this stage; once you have it fitting sweetly it can later be manoeuvred into place from the tank filler.

The little boss alongside the four hand pump fixing screws is a most useful accessory. Many is the time, particularly at the beginning of a season, or on an important occasion, that the suction ball on the hand pump sticks; I know the feeling only too well! Many Clubs have provision for applying boiling water as a cure, it usually works, but merely removing the plug shown and inserting a piece of 13 s.w.g. wire to release the ball is easier, and quicker. This I will try to make a standard feature on all succeeding engines.

Moving to the after end of the tank we come to the injector suction and equaliser pipe connections. It will be easiest to make up the mating parts first, so let us start with the injector suction elbow. With a bit of luck this will be a casting, requiring only cleaning up, facing across the two flanges and drilling the four No. 44 fixing holes; make up the pad, to be attached to the tank bottom, to suit. Turn up the flanges at the bottom of the downcomer pipe from the tanks to the equaliser pipe, four in all will be required at a full 3/32in. thickness to allow for facing off after brazing. Fit the stub pipe and braze it in, then braze the whole to the tank bottom in the position shown. The injector elbow pad can be sweated into position, or silver soldered at the same heating as for the equaliser downcomer pipe.

At this stage in the proceedings readers may note a change from town to country dialect, for these are the first sentences to be typed from the new residence. Instead of standing in the workshop, with the typewriter balanced on the tender chassis for the K1/1, yours truly is now sitting in complete opulence in the "Study", admiring a view of green fields and not getting on with this article!

There are two problems at this stage; the first is that the move is not yet completed, due to the builders still awaiting some vital materials, a common disease these days. The other is that although the workshop is re-erected, it is full of furniture instead carrying out its intended function and as unpacking of all the carefully catalogued drawings and other information has not


9 HOLES No. 44 FROM UPPER CAB SIDES
9 HOLES 3/32 DIA. AND CSK. FOR SNAP HEAD RIVETS - HEADS INSIDE
·093 DIA. ROD OR TUBE
·34 RAD.
2 HOLES No. 51 FROM BUILDER'S PLATE
22 RAD.
CUT-OUT
CUT BACK FOR STEP
14 SWG. STRAP
·25 X ·25 X 16 SWG. BRASS ANGLE
CAB SIDE 1 OFF L.H.; 1 OFF R.H. 16 SWG. MILD STEEL FABRICATION
GAP FOR CAB FLOOR
2 HOLES No. 34 FOR 6BA BOLTS
CAB STEP 2 OFF MILD STEEL
5BA X 1·75 LG. BOLTS
·125 THICK STEEL STRAP - FIT TO PLACE IN 4 POSITIONS
CAB FLOOR HOLDING DOWN ARRGT
1·6MM TK.
CAB WINDOW FRAME 8 OFF POLISHED BRASS (RIVET OR SWEAT TO PLACE)
LAGGING SURROUND (SECTION ONLY) 1 OFF 20 SWG (0·9 MM) POLISHED BRASS NOTE SCREW TO FIREBOX CLEADING
CAB ROOF 1 OFF 16 SWG. MILD STEEL
·25 X ·25 X 16 SWG BRASS ANGLE

yet progressed, one could say I am not organised. Not to worry, things will sort themselves out in due course and it is time to pick up the reins again. But just before doing so I must thank all those readers who took note of the plea to go easy on correspondence over the last few weeks, it was greatly appreciated, the stamped addressed envelopes even more so. On with *Mountaineer*.

The Cab

It is not until one reaches the cab that the stark simplicity of *Mountaineer* really becomes apparent. True some of the fittings that adorn the full size locomotive in 1973, like vacuum brake ejector, steam brake valve, and the impediments of oil firing, have been omitted, but the basic items from the engine as built are included. It is very much doubted whether a water gauge was fitted when new as a series of test cocks, draining into an inclined trough, is still a prominent feature on the backhead; this feature could well be reproduced as a dummy.

Mention was made of brake fittings in the last paragraph, yet brake gear is completely absent from our locomotive. I have mentioned this earlier in the series, but with our worthy Editor's permission, would ask to run briefly through the reasoning once more.

On the full size engine up until 1971 all six coupled wheels were braked. The modifications made at the end of the 1971 season, to the equalised springing, meant that brake hangers could no longer be fitted to the driving wheels, and last season the total engine braking was on the two coupled axles. This feature was not thought worth including on our miniature, being of limited value, but vacuum fittings, capable of braking the train, would be very useful. Builders wishing to include this very useful feature should refer to the notes for *Elaine* and also to the earlier and much more complete description by the designer Brian Hughes. In this case the horizontal valve on the L.H. side of the manifold should be the steam supply for the brake ejector; the steam supply to the top of the water gauge, whose function this valve now serves, can be replaced by a direct connection into the boiler outer wrapper.

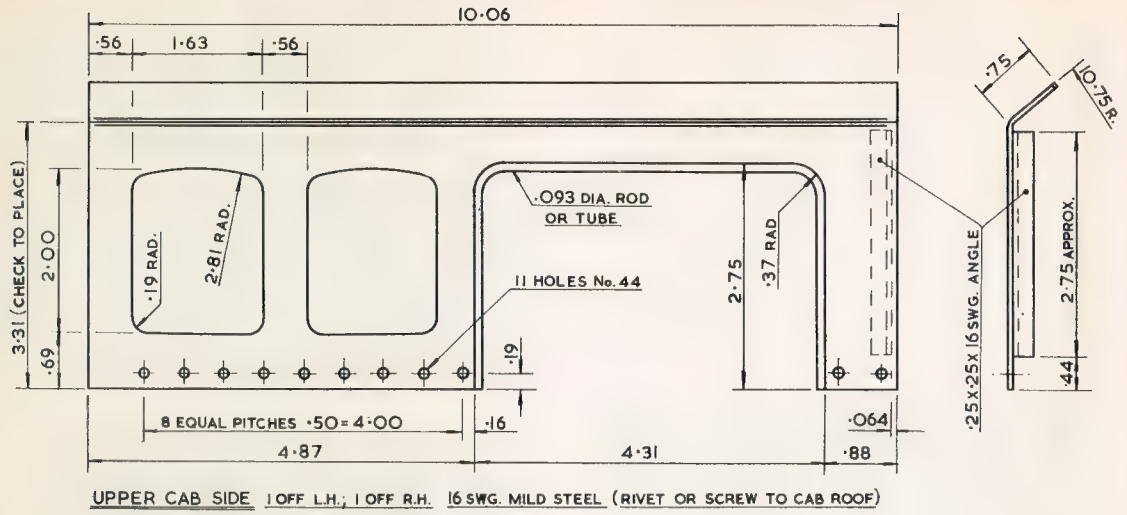
The only other feature to be mentioned before we start work on the spectacle plate is the column type water gauge. This has been adopted in an attempt to obtain a much more stable and accurate measurement of water level in the boiler. Ignoring the very long boiler barrel, the front end of which will simply act as a water heater, the remaining proportions of the boiler are quite conservative for the quantity of steam to be generated. With the boiler steaming freely there will be a lot of disturbance over the firebox, which the column behind the actual gauge glass should dampen quite effectively.

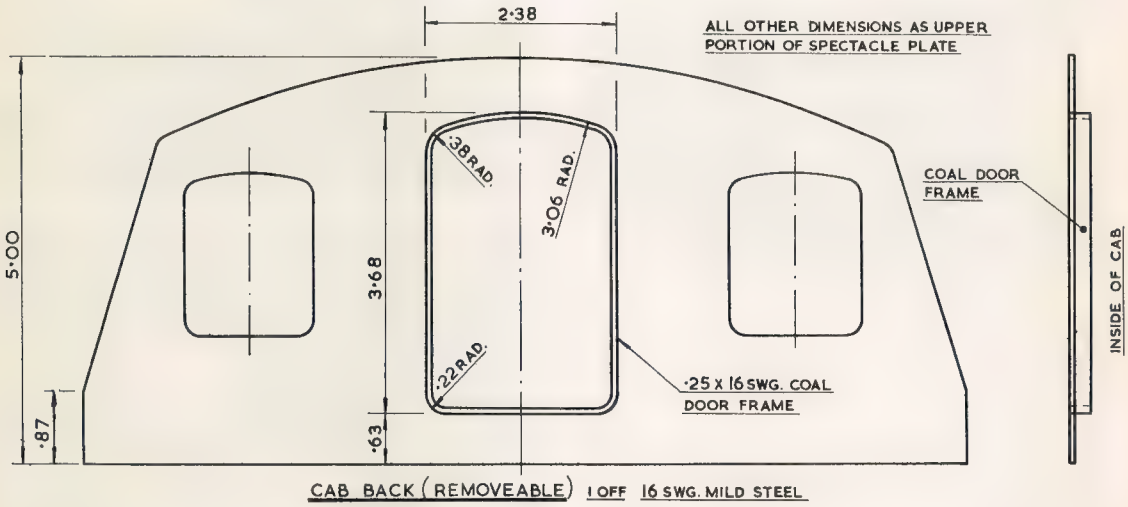
Little needs to be said about constructing the spectacle plate, it is simply cut to the dimensions shown from 16 or 14 s.w.g. steel sheet. Rivet the $\frac{1}{4}$in. $\times$ $\frac{1}{4}$in. $\times$ 1/16in. brass angle around the periphery, then sweat the 3/16in. half round beading to the front face. There is a piece of channel required on the front face, to support the whistles, and this will be shown as a separate detail. Start cutting out around the outer wrapper area, to allow the spectacle plate to begin to assume its final position, but leave a little metal to be removed for final fitting after the floor is in place.

On an engine with such a massive superstructure as our *Mountaineer* it is possible to cut an item like the cab floor into several sizeable pieces. Conversely one can stick to larger assemblies which use less fixings and are usually quicker to dismantle at any time; this is the solution I have arrived at this time. Therefore the cab and bunker floor is indeed a huge area, using almost one square foot of 14 s.w.g. steel sheet. Only a minimum of cutting out is required, just sufficient to clear the boiler and blow down valve, the latter yet to be made. Rivet on a pair of $\frac{1}{4}$in. square steel stiffeners at the edge of the sheet alongside the firebox, this is more important on the L.H. side to add stiffness in way of the reverser stand. Once this floor has been placed the reverser can come down from its sky hooks and return to terra firma.

The rear end of the sheet is supported over the drag beam; two further supports are required to provide a rigid structure and these are fashioned from 1in. $\times$ $\frac{1}{8}$in. steel flat to the dimensions shown. It will probably be imprudent to silver solder these supports to the floor, for reasons of distortion, so rivet on using lengths of $\frac{3}{8}$in. $\times$ $\frac{3}{8}$in. $\times$ $\frac{1}{8}$in. angle for the joint.

Erect on the frames, after drilling all the holes specified, spot through the five No. 27 holes onto the drag beam angle, drill this latter through at No. 34 and tap 4BA. Our floor is now positively located, thanks to those slots in the other cab supports; bearers might be a better name. To hold the cab floor to the frames more securely, the strap and bolt arrangement shown should be adopted at the four positions where the bearers cross the frames. These can only be made to place and must be positioned clear of all other fitments, like the reverser stand.





The spectacle plate can now be completed and fixed to the floor with a few 6 or 8BA screws. Attach the after end of the valances to the spectacle plate and we can move on to the cab sides.

The basis of the cab sides is two pieces of 16 s.w.g. mild steel sheet, each size 7⅞in. × 5½in. Cut away the top corner as shown, followed by the scallop on the rear bottom corner. Mark off then drill and file out the little cut-out for the step pocket. Make this pocket from 16 s.w.g. steel or brass strip, braze up and either braze or sweat to the cab side. Along the top face, rivet on a 4 9/16in. length of ¾in. × 1/16in. steel or brass strip, these rivets being of the snap head variety and 3/32in. diameter. Set the upper ⅜in. in by 17 deg., which can be done by eye, for the upper cab sides.

Next rivet on a full length of ¼in. × ¼in. × 1/16in. brass angle to the bottom edge of the cab sides, cutting the vertical face of the angle by ½in. at the rear end to clear the cab step. Offer up to the cab floor and spectacle plate, securing temporarily with a few 8BA countersunk head screws. We can now deal with the rear edge of the cab side; cut from 16 s.w.g. material to the shape shown on the rear view and sweat to the cab side. Additional fixing can be provided at the bottom, to the cab floor, with a short length of ¼in. brass angle.

To be continued

7¼ inch gauge Society

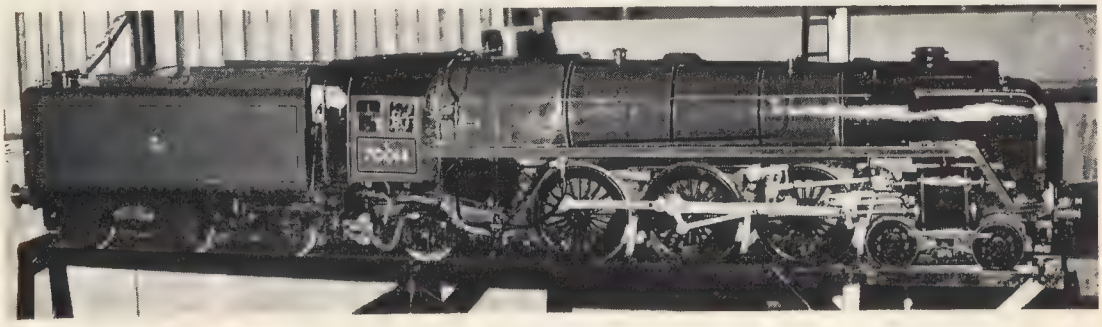
by Rodney Weaver

THE 7¼ inch gauge Society was formed in October 1973 and is now beginning to function in its intended role as a forum—and source of inspiration—for those interested in this gauge. Formation of a Midland Area followed quickly upon the establishment of the main body, for an enthusiastic group of 7¼in. operators has been active in the Coventry area for many years. The close ties with other model engineers in the area,

A 4 in. scale model of "Dolbadarn", — Hunslet 0-4-0T of 1922, built by R. H. Marsh and owned by K. Blackham.

Right (top to bottom): An unfinished type A "Shay" locomotive by D. Bates. Falcon 4-4-0 by R. H. Marsh, owned by K. Blackham. Photographs by the author. "Tinkerbell", by R. Marsh. Photograph: W. Skinner.

Below: "Iron Duke", a 7¼ in. gauge "Britannia" owned by Col. R. J. Hoare. Photograph: R. J. Blenkinsop.



partly a result of the Town & Country Festival held at the National Agricultural Centre each year, led to this group staging the first official exhibition stand of the 7¼in. Society at the Coventry Exhibition on March 28th-31st. Those involved were well pleased with the result, it being generally agreed that they had taken part in one of the best exhibitions of its kind ever staged in the Midlands.

This being the first real attempt to "sell" 7¼in. gauge, the emphasis was more on the possibilities of the gauge rather than on highly-detailed engineering, which is a fairly true reflection of the interests of many of the members responsible for the display. Twelve complete locomotives, ranging from 1½in. scale 0-4-0's up to a 3.6in. scale narrow gauge 4-4-0, three part-built locomotives and some items of rolling stock were on display. Two of the largest locomotives were placed in the entrance to the exhibition. One of these was Roger Marsh's Heywood-type 0-4-2T *Tinkerbell*, which featured in "M.E." some time ago when it was temporarily converted to oil firing. This is a most imposing machine, one of the few 7¼in. tank locomotives on which the driver actually sits on the locomotive itself, and is claimed by its builder to be a true industrial locomotive because it is steamed regularly to move things about his garden.

Alongside stood another locomotive by Roger Marsh, a 3.6in. scale model of the 2ft. gauge Falcon 4-4-0 originally built for the Beira Railway, later used on the Zebedelia Citrus Estates and now preserved in Milner Park, Johannesburg, by the Rand Society of Model Engineers. *Zebedelia* is owned by K. Blackham of Harbury and was built from drawings of the 5in. gauge model which runs on the Rand Society's track. This too is a locomotive that one rides in rather than on and despite its size gives the driver a much greater sense of security than does a locomotive of more usual proportions.

The star exhibit on the main stand, and indeed one of the star exhibits of the whole show, was "Britannia" class 4-6-2 70014 *Iron Duke*, owned by Col. R. J. Hoare and exhibited on his behalf by C. P. Weaver of Kenilworth, who has spent the last six years overhauling this locomotive. *Iron Duke* was built by L. Willoughby using the original B.R. drawings and featured in "M.E." of 6th January 1955. To have built this locomotive virtually single-handed using a 4in. round bed Drummond lathe, including a solo silver soldering operation on the boiler using three 5-pint blowlamps, was no mean feat. It was displayed on the special erecting stand built for its overhaul, which incorporates a wheel-drop, and is now awaiting its first proper test under steam since completion of its lengthy overhaul. *Iron Duke* brought back many memories of steam days on the Southern Region—one visitor to the exhibition had actually fired the prototype—and by sheer coincidence the "00" layout at the other end of the hall featured an S.R. boat express hauled by the sister locomotive at Stewarts Lane, *William Shakespeare*.

There were two more large locomotives on the stand. *Dolbadarn*, a 4in. scale model of a Hunslet 2ft. gauge quarry locomotive—No. 1430 of 1922 for the Dinorwic Slate Quarries, now on the Llanberis Lake Railway—was yet another Roger Marsh product owned by Ken Blackham. Being a large-scale model of what is already a very simple and robust locomotive, this is an excellent example of a locomotive which is both practical and aesthetically pleasing. *Dolbadarn* was coupled to a 4in. scale slate wagon, based on those built by the London & North Western Railway for use in connection with their transhipment sidings at Blaenau Ffestiniog, a simple vehicle which makes an excellent and appropriate driving truck for the locomotive. Behind them, on the same length of track, stood another narrow gauge "train" comprising Vale of Rheidol 2-6-2T No. 8 and a bogie carriage. Both are owned by D. Bates of Leamington Hastings: the locomotive was originally built for 5in. gauge and is thus of 2½in. scale only. It proved unstable on this gauge and was rebuilt by Dennis Bates to 7¼in. gauge, forming the nucleus of his varied collection. The coach, built to go with it, has a removable roof and can be used either as a passenger carrying vehicle or as a scale vehicle. It is rare for anyone not familiar with the Rheidol locomotives to spot the alteration to this locomotive.

Another of Dennis Bates's models created a good deal of interest, this being a Shay locomotive based on the two-cylinder, two-truck Type "A" locomotive of the Lima Locomotive Works. The "A" was the smallest type of Shay, weighing a mere ten tons. The model was incomplete, but could be run on compressed air and never lacked an audience when it was running. The primaeval cardean shafts, with their plain Hooke joints and square telescopic sections, may look crude but remained unchallenged on the logging lines of North America and elsewhere for almost a century. The excellent adhesion and riding of the Shay would seem to make it suitable for up-and-down portable track work and I am surprised that there are not more models of them.

Some years ago Mr. Bates obtained details of the early Sentinel narrow gauge locomotives and

decided to build one as an exercise in rapid construction. The result, which is based on Sentinel 6770 of the Cliffe Hill Railway in Leicestershire, was a very simple yet convincing locomotive with a reasonable performance on the track and a very satisfying exhaust note. The locomotive has a vertical boiler, overscale but still fired from the top in correct fashion, and a single-cylinder Stuart engine with two-stage chain drive. It is now owned by D. Kempton of Shipston-on-Stour. Though quite unlike most locomotives that one sees at exhibitions of this kind, the Sentinel attracted much interest and more than one model engineer was observed taking surreptitious measurements from it!

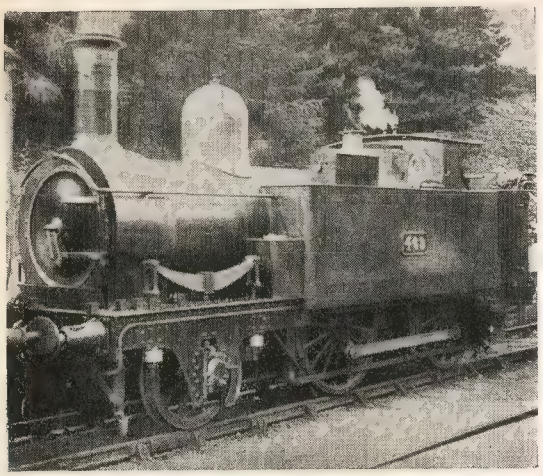
Keeping the Sentinel company on a length of track was *Bendigo*, owned by K. Blackham. This started life as a "Midge" but was altered to a narrow-gauge outline to conform to the owner's interests (and to make the controls accessible!), being fitted with a ogee tank. The recent correspondence about grates with wide air spaces is an interesting example of the same idea occurring to different people at different times, for *Bendigo* was fitted with a stainless steel grate to the present writer's design some six years ago. The bars were 18 swg set at ¼in. centres and although the grate was only brazed it lasted for more than five years before regular excursions into red heat caused disintegration through the braze metal diffusing into the bars. It has been replaced by a similar grate made in more durable material.

The stand was completed by three 1½in. scale locomotives. *Rosabel*, built by D. Walters of Kenilworth, is an industrial 0-4-0ST based loosely on the practice of Hudswell Clarke and Hawthorn Leslie. By a strange coincidence it resembles the locomotive used as an emblem by the Industrial Railway Society, which is also a synthetic design and was drawn up quite independently. Originally fitted with a saturated boiler, *Rosabel* has been rebuilt with a superheated Belaire boiler during the past winter as a result of experience gained at two Town & Country Festivals hauling heavy trains. On her home track *Rosabel* hauls scale wagons and one of these was also on show. The other small locomotives were owned by B. Goodchild of Leamington Spa and comprised a GWR 1366 class 0-6-0PT built by K. E. Wilson and a LSWR B4 class 0-4-0T by J. G. S. Clarke. Taken together these three small locomotives demonstrated how compact and manageable a 7¼in. gauge locomotive can be, and although smaller than many 5in. locomotives they can hold their own with the bigger machines on a reasonably level track.

The incomplete locomotives were quite varied. A recent convert to 7¼in. gauge is John Drury, Chairman of Coventry MES and the first winner of I.M.L.E.C., whose well-known 5in. gauge locomotives were on display elsewhere in the hall. He has started to build a free-lance narrow gauge tank locomotive with a Bagnall pattern marine firebox and was exhibiting the frames for this locomotive, which promises to be a useful addition to the local scene. Although very basic this machine will probably turn out to be little smaller than *Dolbadarn*. A newcomer to live steam is G. Webster from Stoke Golding, who is building a Baguley 2ft. gauge locomotive in 3.6in. scale using the makers' drawings. The original incorporated some rather elaborate cast frame stretchers, so to avoid the trouble and expense of getting these cast the builder started to fabricate them. He is now proposing to fabricate all the castings except the wheels and exhibited samples of such fabrications, including the frame stretchers, smokebox saddle and parts for the spark-arrestor chimney. Another newcomer to live steam is Clive Parsons from Meriden, who at the age of twelve was possibly the youngest exhibitor in the show. Clive started his "career" as a cleaner on the 7¼in. layout at Stoneleigh last year and subsequently began a "Tich Major", which has involved scaling up the original LBSC design under the guidance of other members of the society. The frames and other parts for his locomotive were displayed in the slate wagon behind *Dolbadarn*.

The stand was completed by *Hippo*, a 0-6-0 petrol locomotive based externally upon B.R. diesel shunter practice and powered by a 1½hp JAP engine; this is owned by D. Kempton and acts as standby to the smaller steam locomotives when out on portable track duty. There were also two signals by D. Bates and—a last minute inspiration—a back-projection unit made from an old television set. This was thought up by Ken Blackham and, despite showing films the wrong way round in its basic form, it proved a great crowd puller. If nothing else it has caused some people to have a fresh look at the projection of films to small audiences, and as a means of injecting "life" into what is inevitably a rather static display it has considerable potential for development.

It is thought that this was one of the largest displays of 7¼in. gauge equipment ever seen at a model engineering exhibition. The members responsible were pleased to have taken part in such a well-balanced and well-presented show, and it would have been hard to find a better way of shaking off the effects of winter, or indeed of launching the active career of a new society.



METRO

A new locomotive for 5 in. gauge based on the Great Western Railway "Small Metro" class

by Martin Evans

Part XIV *Continued from page 653*

THE NEXT ITEMS to be tackled are the side tanks and the emergency hand pump. There is quite a lot of work in the tanks, and it should be noted that there are several differences between the left-hand and the right-hand tank. It will also be noted that the tanks overhang the running boards quite considerably, and that the sides of the tank end well below the level of the running board, although the floor rests on top of the running board.

I think 1/16in. hard brass sheet is the most suitable material for the tanks, as this will give much needed weight over the driving and coupled wheels, and as there is no bending to be done, this thickness will ensure a strong assembly.

Note that the floor of the side tanks fits in between the two sides, and there are two quite large "splashers" inside, to clear the driving and coupled wheels. The various parts can be held together with brass angles ¼in. × ¼in. × 1/16in., on the inside, 8 BA brass screws being put in from the outside, after tapping right through both plate and angle. The screws are then cut off, and after soft soldering has been completed, filed flush on the outside.

A single bulkhead should be sufficient to ensure that the sides are sufficiently rigid, and this is situated immediately next to the driving wheel splasher. A few large holes can be drilled in this, near the bottom edge, to allow free water flow.

The hand pump is screwed to a piece of brass strip of 1in. × ⅛in. section, which is itself soft soldered to a length of brass angle 1in. × ¾in. × ⅛in., fixed to the side of the tank. Four 4 BA brass cheesehead screws are then used to hold the pump down, these screws being easily reached through the top of the tank, if it is desired to remove the pump for servicing etc.

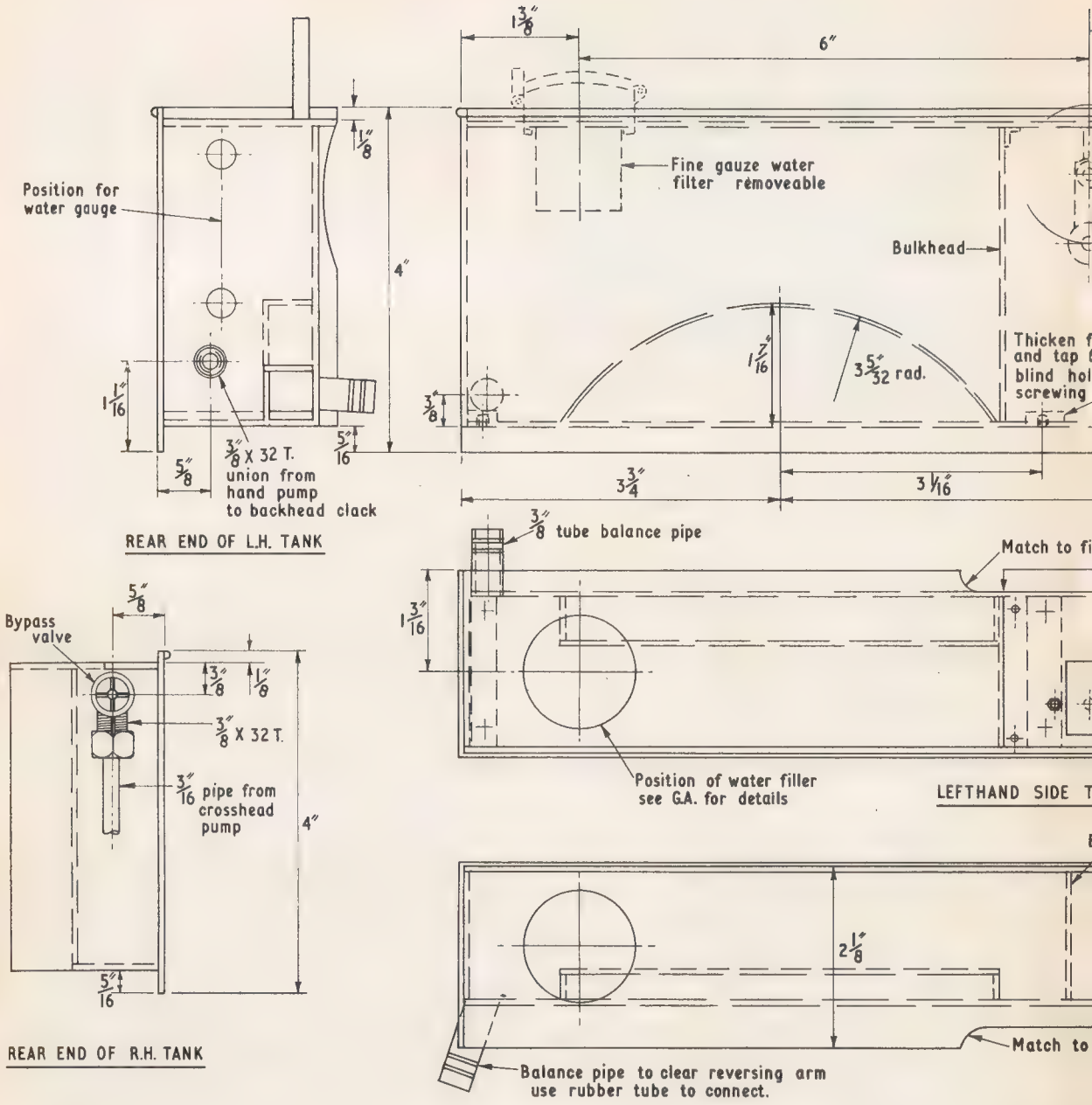
Each side tank is furnished with a length of 3/16in. dia. brass tube about 1¼in. long, to act as an air vent, and the usual water fillers are provided on each side, fitted with removeable filters—which can be made up from the fine gauze sold for motor-cycle petrol filters.

Originally, I intended to provide an additional tank for water at the bottom of the bunker, but I came to the conclusion that there were too many difficulties in trying to squeeze this in, and in any case, such a tank could not have made any great difference to the total water capacity.

Another point to notice is that there are three strips of brass about ⅛in. thick soft soldered to the floor of each tank to thicken the floor so that screws can be put through the running board from the underside, to hold the tanks down firmly. These tapped holes (6 BA would be a convenient size) must be "blind" ones, to prevent leakage, so they should be drilled with care.

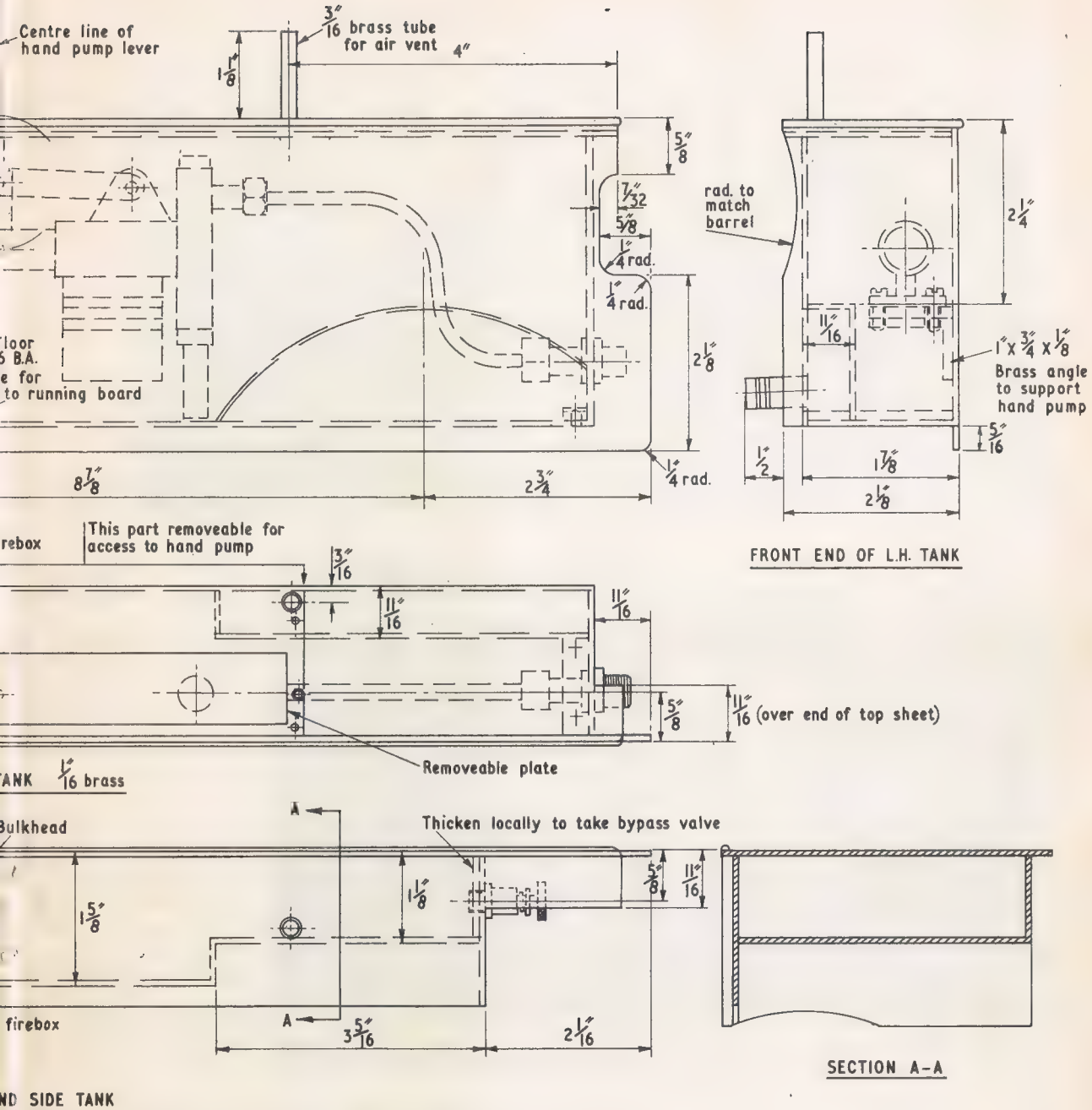
To connect the two tanks, rubber tube is used. Short lengths of ⅜in. dia. brass or copper tube are soldered into the lower front corners of each tank, that in the right-hand tank being put in at an angle, as shown in the drawings, so as to avoid the reversing arm, which comes rather close at this point. Although rubber tube is not particularly "railway-like", it will be found very convenient, enabling either side tank to be dismantled quickly, without disturbing anything other than the cab front and sides.

A screw-down angle valve is fitted to the rear end of the right-hand tank for the by-pass from the crosshead pump, and to enable the driver to see what, if anything, is coming through this, back to the tank, a small removeable cover or manhole (not shown in the drawings) should be arranged in the top of the tank above the valve.



Most drivers like to know at a glance how much water they have in the side tanks, and I have noticed that recently, several owners of tank locomotives have fitted water gauges very similar to those fitted to boiler backheads, using 3/16 or $\frac{1}{4}$ in. dia. glasses.

This seems a very good idea, and if builders wish to fit such a water gauge to their tanks, the best position is probably on the back plate of the left-hand tank, just above the outlet union from the hand pump. The right-hand side is not so good, owing to the reversing screw being rather close, also the bypass valve. An additional refinement would be a screw down valve in the bottom fitting of the water gauge, so that the glass can be cleared from time to time. Use $\frac{1}{4}$ in. dia. glass,



and rig up a simple glass protector from brass sheet about 20 s.w.g. just in case a careless driver should clout the glass with his firing irons!

The side tanks can be completed by the addition of 3/32 in. half-round brass beading, along the top edges of the sides and the front, but not along the rear plate. This incidentally is another reason for using brass rather than steel or aluminium.

The cast brass number plate, typical of Great Western engines, is attached to the sides of the tanks by four 1/32 in. brass or nickel rivets (round-head). Our Birmingham friends will probably be able to oblige with these number plates.

Above: "Small Metro" No. 1492. This engine appears to be in original condition.

Left: A much later photograph; No. 1456 with enlarged cab and bunker and strengthened frames.

Horns for leading wheels

A reader who is building *Metro* has pointed out that with the width (⅜ in.) given for the base (bolting face) of the leading horns, and the spacing of the 1/16in. dia. holes in the outside frame, there is insufficient room for the heads of the rivets on the inside. The base of these horns should therefore be made slightly wider, say 7/16in.

Another builder says that the working surfaces of the crosshead "slippers" are too narrow, and may wear rather quickly. (Page 184, February 15th). It is not easy to increase the width of the crosshead slippers very much, but as the crossheads do not pass through the motion plate, the overall width could I think be increased to ¼in. (It is now 11/16in.) without fouling anything.

To be continued

A Bournemouth Visit

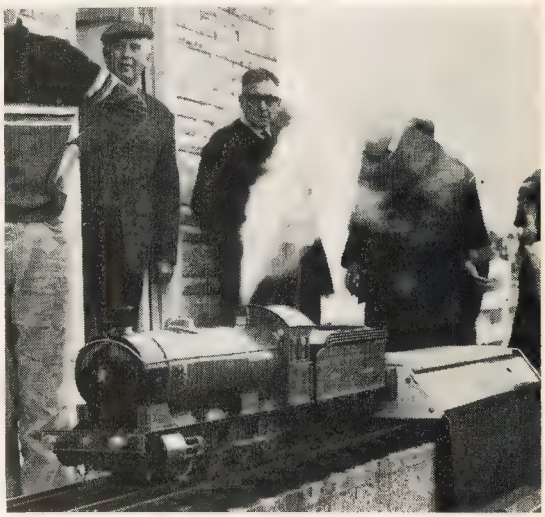
The Editor has a busman's holiday.

Reported by

D. E. Lawrence

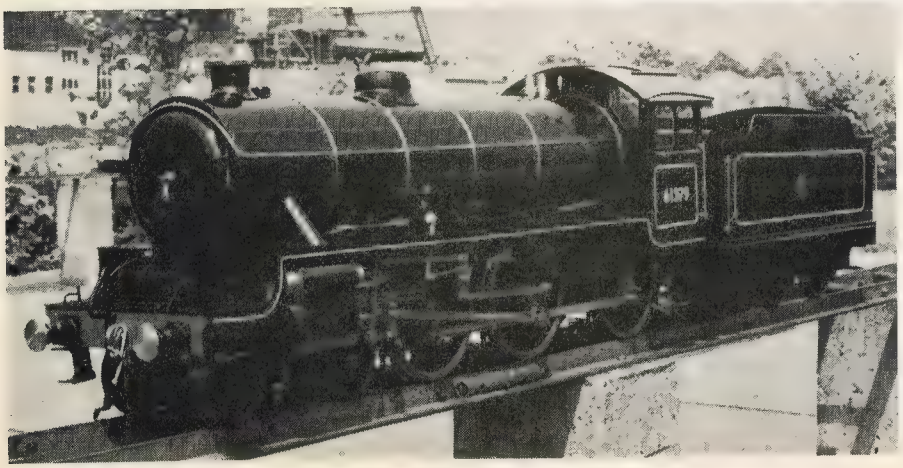
The Editor drives the "Springbok".

Below: Mike Styles' new 3½ in. gauge N.E.R. 0-8-0 blows off at the station.



THE BOURNEMOUTH Society has received very little mention in "M.E.", which is hardly surprising as it is of quite modest size and rarely takes the opportunity of blowing its own trumpet. I have the honour to be the Society's President and as far as I can find out, it was formed about 65 years ago, since when it has had its share of ups and downs. 65 years, of course, calls for some sort of celebration and our informal effort in this direction has been to enjoy a little more club activity during the year.

Martin Evans very kindly accepted our invitation to spend the Spring Bank Holiday week-end with us and he gave a talk, supported by examples of his own work, on "Some Aspects of Model Locomotive Design" at a well attended evening meeting. The next day he spent an afternoon and evening in congenial company at our track in King's Park. Our track is a 1,764ft. circuit and is acknowledged to be amongst the finest in the country. (Of course, we think it is the best, but then we're prejudiced!). Mr. Evans was shown round the track, which now has more gauges and facilities than on his first visit to us about 6 years ago. A previous discussion on track building led to him being shown my method of laying rails to a tolerance of not more than 6 thousands of an inch plus on the gauge!!



Left: The 5 in. gauge "Springbok" recently completed by Bertie Green of the Chichester Society.

We also invited Bertie Green of Petersfield, who is a friend of both Martin Evans and myself. Bertie had his I.M.L.E.C. 1974 entrant, a LNER 5in. gauge *Springbok*, with him and your Editor enjoyed himself driving this locomotive. Now and again we let Bertie have a drive of his own engine!

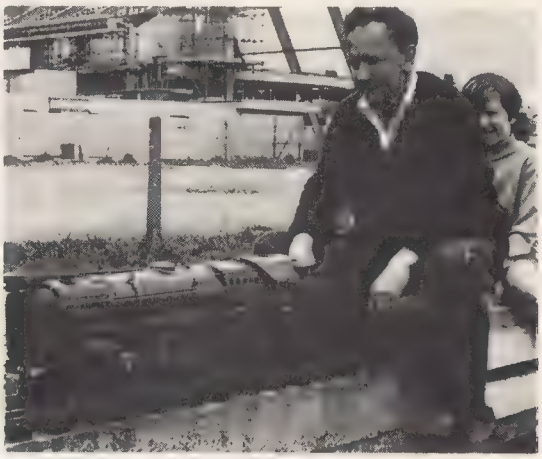
The two club locomotives, a 5in. gauge *Maid of Kent* and a 5in. gauge *Speedy* were both running. These two locomotives are getting on in years, they total 30 years service and are often used for training the younger members in addition to taking a share of the public passenger hauling service on Sunday afternoons.

The Society was very glad to entertain Martin Evans and we feel sure he enjoyed his visit to the Sunny South. For a small Society, the turnout of locomotives was quite considerable and the photographs show some of those present.

Mike Stannard with his 3½ in. gauge L.N.W.R. "Precursor".

Below: Left to right — Bournemouth Chairman Lyn Wright, Past President Institute of Handicraft Teachers, The Editor, D. E. Lawrence.

"Springbok" was given some real work to do! Dave Edwards driving.



Chief Engineer John Clothier with 3½ in. gauge "Britannia".

Below: Secretary Bob Atkins with the Society's "Maid of Kent".

Group Captain Law with his 5 in. gauge "Ajax", and anxious little girl watches!

Above right: John Alsop's 5 in. gauge "Simplex" runs very well.

Right: Another view of "Springbok".

A Garden Railway in South Africa

by J. W. Love

THIS PROJECT changed from hopeful dreaming to a reality when I was able to purchase a 20ft. wide strip of ground from my neighbour, thus increasing my ground size to 102ft. by 82ft. As I had committed myself to build a S.A.R. 25 NC Class engine in 1/12 scale, curves with a minimum radius of 30 feet widened to 3 9/16in. were essential. An established garden necessitated a careful route survey which was done from a scale drawing detailing the exact positions of trees, trellis, flower beds, bushes and any outbuildings. A ground level track was decided on on the grounds of realism, a locomotive of over 220lb. dry weight and the fact that there were to be two crossings of the motorcar driveway. In addition a branch line to a steaming bay was required. Consequently the problems of maintenance and the need for accuracy were appreciated from the beginning.

The location has an average winter rainfall of 40 to 60in., varying from a light drizzle to storm intensity. Moles which burrow shallow runs just below the surface in the sandy soil were another problem to be overcome. A construction resistant to storms, of good drainage and unattractive to moles was an essential part of the design.

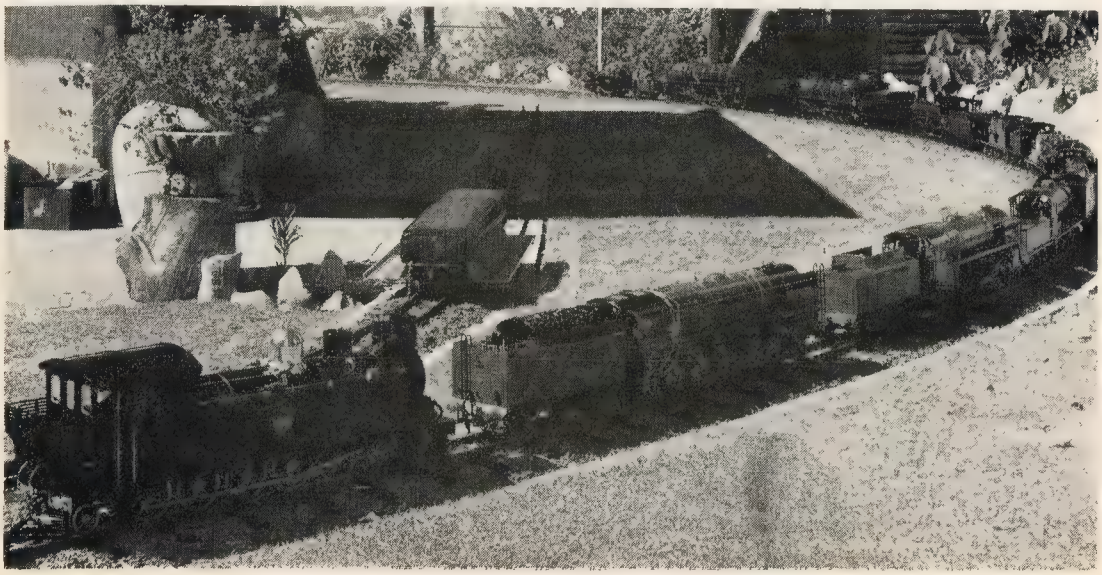
The route was then plotted. With one exception all the curve centres were inside the house. Setting out by triangulation after calculating transitions, and checking by chords, has given an acceptable line on the curves. Numbered pegs were then driven in at 10ft. intervals, leaving about 3 to 4in. above the ground. Bill Schutz,

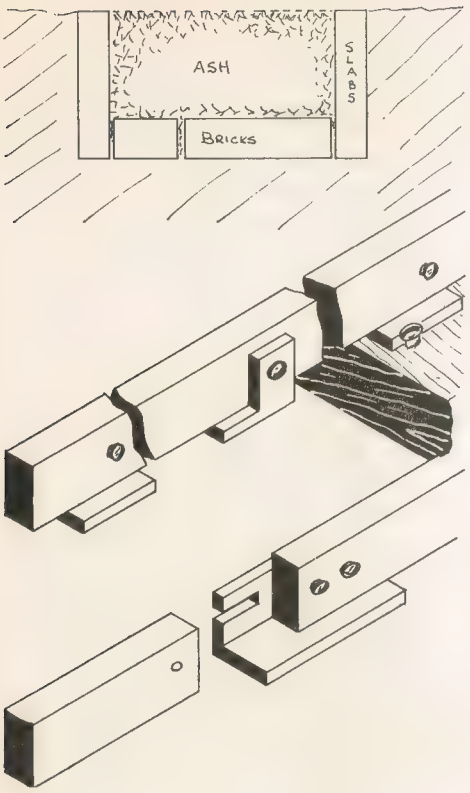
J. Hugo with S.A.R. "16E", J. Burbridge and Jimmy Scott with American "Atlantic", coupled together and at speed on down straight.

who many years ago as a young civil engineer had surveyed and constructed railways in Zambia (then Northern Rhodesia), accurately surveyed the top height and ground height at each peg. Two profiles with an exaggerated vertical scale were then drawn: one showed the existing ground profile and the other the proposed bed of the track. Each peg was marked to indicate the precise bed level. The highest and lowest points were almost diagonally opposite and the difference exactly 14in. Existing stormwater drains and the motorcar drive fixed certain levels, and for the rest it was found possible to build with a minimum of filling and cutting. Ruling gradients vary from a short 1:98 on a curve to a long 1:133 which includes a 30ft. straight.

A borrowed trailer with limited loading capacity was hitched to my Land Rover on 24th June when I started 3 weeks leave. Dozens of small pegs were driven in to define the width of the trench and the job of excavating almost 250 feet of soil to a depth of 10in. and width of 18in. was started. It is truly amazing how many roots and how much rubble one finds. Grass sods and soil were loaded on to a wheelbarrow and transferred to the trailer standing in the street. The trailer was emptied at a point about two miles distant and the return journey made by

The line-up before breaking the tape — on the back curve. Photographs by Dick Pearce.





J. Hugo on the back curve.
Left: Details of track construction.

way of one of the local power stations where I was able to load damp, clean fine ash. This travelling pattern was adhered to during most of the earthwork.

When about 20 feet of trench had been excavated, a plumber friend, Jim Strangwayes, who as a result of his calling has a keen sense of levels, took over the job of setting the vertical cement/sand slabs 18in. × 9in. × 2in. along the sides of the trench. This was considered to be one of the critical operations. As the trench bent into the curve, each successive outer slab was raised $\frac{1}{8}$in. until the 5th one reached the planned maximum height of $\frac{5}{8}$in. above the inner slab opposite it. This difference was retained as the ruling super-elevation along the curve, and eased similarly as the next straight was reached. The fact that levels are not taken from a centre line along the track does not appear to be significant.

Surplus assorted bricks left over from a new room extension a year previously were pressed into service to make a single layer lining at the bottom of the trench. These were stamped down very firmly as was the damp ash fill until the bed was level with the top of the slabs, as above. This method of construction drains well and appears to be both stable and capable of restricting the moles' enthusiasm.

As the foundations progressed—faster at weekends—the workshop was closed to locomotive construction. The $\frac{1}{2}$in. bench drill was moved on to a new wooden pedestal to enable it to accept 9ft. 6in. lengths of rail. Outside an improvised bench was erected and fitted with a metalworker's vice. Here the rails were cut to length and the rollers for bending the rails held. Two pairs of "jim crows" suitably handled and six spacing jigs adjustable between $3\frac{1}{2}$in. to 3 9/16in. were added to the basic tools. The "jim crow", an old tree stump and a 4lb. hammer were very handy tools to teach the rails "good manners" as LBSC would have said.

700 sleepers $10\frac{1}{2}$in. × $1\frac{3}{8}$in. × $\frac{7}{8}$in. were sawn up and dumped in batches in wood preservative. The timbers used were afromosia, sapele mahogany and dark meranti. Some available old teak and jarrah was rejected as it had lost its character and in any case my supply source was reasonably priced. Perhaps the most trying job was the preparing of the chairs for fixing the rails to the sleepers. Two friends with access to power saws kindly cut $\frac{3}{4}$in. × $\frac{1}{8}$in. angle iron into some 1400 pieces 1in. long, leaving 6in. off-cuts too short for the machine saw. These pieces were cut to 2 in. lengths for the fishplates. My sketch shows how the chairs were shaped for attachment to the rails. Spacing was at 6in. centres with each successive pair facing inwards and outwards. To establish the position of the chairs, the rails were laid on the sleepers and the positions marked,

then each rail was transferred to the workshop and the chairs located, drilled and secured with $\frac{1}{8}$in. × $\frac{1}{4}$in. RH iron rivets. The chairs were fixed to the sleepers with No. 8 × $\frac{1}{4}$in. RH black japanned wood screws. Brass screws would no doubt have been better. This type of chair was used by Bill Schutz on his ground level track and after 16 years it remains an excellent road.

Aluminium alloy rails had been imported a few years previously, but in the final reckoning these were rejected in favour of mild steel section $\frac{1}{4}$in. × $\frac{1}{8}$in. It was felt that in the early stages of track testing any serious slack, with a high axle loading, may have put a set in the light alloy rail. I did not carry out any tests so that my decision was not scientific and I am open to correction. Immediately below each fishplate a 2in. wide sleeper was positioned to absorb flexing of the joint. Rust-proofing has been entrusted to Shell Ensis 264 which is easy to apply and gives a clean and abrasion-resistant finish.

The first 100 feet of track was laid on a bed well scoured by rain and completed by early August. *Juliet* was put into steam and one truck coupled up. Jimmy Scott and Jack Busbridge, both experienced track builders, happened to call in, and we took turns in testing the section of track. This unballasted and rain washed section was satisfactory. By 24th November the circuit had been completed and most sections were ballasted. The two crossings of the drive had been reinforced to carry the weight of motorcars crossing. Both these crossings and the 42in. bridge to avoid tree roots were still very exposed when Scott on that day drove his new S.A.R. H class 4-10-2 for the first time. Speeds were held down and the track very closely scrutinised for defects. In due course the drive crossings were closed with small stone tarmacadam and the bridge plated. Loose bridge plates give a realistic rumble.

Two points of interest showed up during the early stages of track testing. The short 10ft. straight was held to a sustained 1/16in. super-elevation on the outer rail throughout its full length. This agreed fairly well with the policy of starting the super-elevation about 5ft. on the straight before the curve and rising to 1/16in. as it reaches the start of the curve and for the next 6 to 8ft. rising to a full 5/32in. which is held for the curve. A track giving a riding speed in comfort and safety of about 5 mph had been aimed at. On a recent test Busbridge driving my Juliet and hauling two trucks comfortably lapped for four consecutive laps at an average speed of 6.76 mph without any problems. Anyone building their own track should realise that these figures for super-elevation are only empirical.

The final project has the addition of a branch line to a steaming bay ending in a turntable. This section is about 40ft. long and rises to about $7\frac{1}{2}$in. on two gradients of 1:120 from the points and then 1:40 on the metal legs to the turntable. The turntable is a length of channel iron, 84in. × 4in. × 2in. × $\frac{1}{4}$in., set with an adjustable plate on a front motorcar wheel hub concreted into the ground. A matching section of track 9ft. long can be placed at a point near the turntable to function as an ambulance section. The engine can then be pushed off the turntable on to this ambulance which can then be placed on trestles for convenient working, inspection and adjustment. Port Elizabeth Steamers' new track inspired the design of the points which work very well. These are positive in action and do not have the disadvantage of facing blades. Gradient boards, whistle signs, station name boards and a water tower complete the accessories and delivery is awaited on a full size old Cape Government Railways (circa 1895) gantry signal to achieve the correct atmosphere. Should the traffic justify it, some type of signalling will be contemplated and made.

Prior to the official opening on 9th March, the road was well tried and tested. Shortly after Christmas, John Wakefield (Adelaide Live Steamers, Australia) twice visited the track. He is an accomplished driver and handled Jack Busbridge's *Netta* and my *Evening Star*. At the opening ceremony there was an impressive line-up of 17 locomotives. Jimmy Scott drove in the traditional last spike and then with his 25 year old American type "Atlantic" broke the tape. Building a track is indeed hard work, but the final result can be most rewarding and very convenient for doing your own testing.

ERRATUM

"Dividing" by W. H. Balshaw, Postbag, page 617. 7th line onwards should read:

"My own method of dividing in the lathe is simply a diametrical pitch worm mounted on a spindle on which can be fixed any of the change wheels which act as the division plates. The worm is arranged to mesh with any of the change wheels mounted on the end of the mandrel . . ."

A RHODESIA RAILWAYS 19th. CLASS LOCOMOTIVE

by G. W. Binns-Ward

LAST YEAR I completed a one inch scale model of the Rhodesia Railways 19th class locomotive, which is derived from and is almost identical to the S.A.R.s Class 19D. The main external difference is in the design of the twelve wheel tender bogies, S.A.R. being Buckeye type and the R.R. plate frame.

Our gauge being 3ft. 6in. makes the model a very big 3½in. gauge indeed. Length overall 7ft. 2½in., loading gauge 13½in. × 9½in. wide, weight over 250lb.

The locomotive has been built very close to scale, even to invisible and internal details. The main diversions from scale being tube size, superheaters, throttle valve, cylinder drain cocks and cylinder block coring. The driving and coupled wheels are temporary, made from the only ready made castings I could get having 22 spokes. I am making patterns for the correct 14 spoke wheels at present.

Rhodesia Railways very kindly provided me with 64 copies of the original drawings. This was probably in one way a mistake, because having so many drawings I started making every part to detail.

For instance the bar frames had two drawings for profile and another two for frame drilling. I converted all the hole spacings measurements to scale to the nearest ten thou and proceeded to mark out and drill the frames to scale, thus providing probably three times as many bolts as would be needed for practical purposes and giving myself four times as much work.

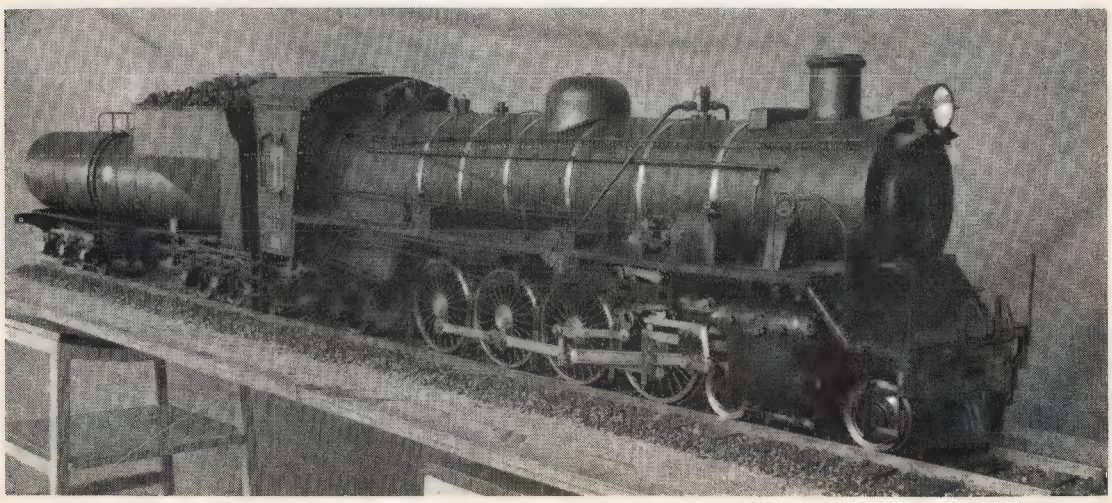
Only about ten per cent of these bolts can be seen, and the only reward is that I can say that there is a bolt on the model for every bolt on the prototype. All the other parts are built in the same way true to prototype, regardless of the fact that most of the detail cannot be seen when the model is finished.

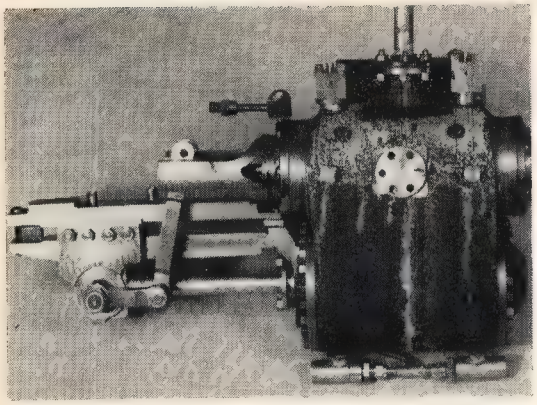
There being no access to the trade due to sanctions and the model not a standard published design, I have either fabricated or made patterns for every part. The only purchased parts were the temporary coupled wheels, the pressure gauge and about £25 worth of hexagon-head BA bolts and nuts.

Some might ask why I did not make these too. The answer is (a) there is over 2,000 of them, with a large percentage 7-10 BA, and (b) small hex rod is unobtainable here.

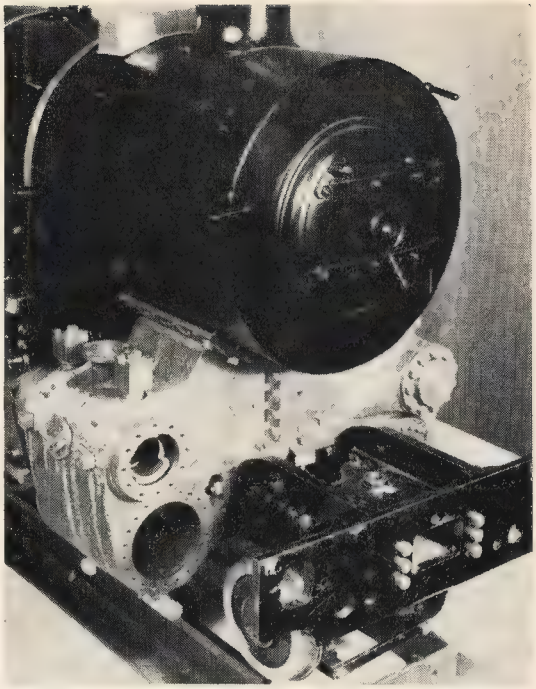
Some details that might be of interest:— Frames, bar type, flame cut from 4in. thick plate on the prototype, machined from 5/16in. plate on the model. Cylinders, 42mm × 2⅛in. stroke, cast in two halves integral with smokebox saddle, cast iron with stainless steel steam chest liners. Cylinder covers and pistons contoured to scale inside as well as out. Bronze pistons and valve bobbins, cast iron rings two per piston and four per bobbin. Steam operated drain cocks to Mr. Ranford's design (ex M.E.). Hydraulic relief valves to steam chests.

Adjustable taper horn cheeks for coupled





One of the cylinders, with crosshead, slide bars and drain cocks.

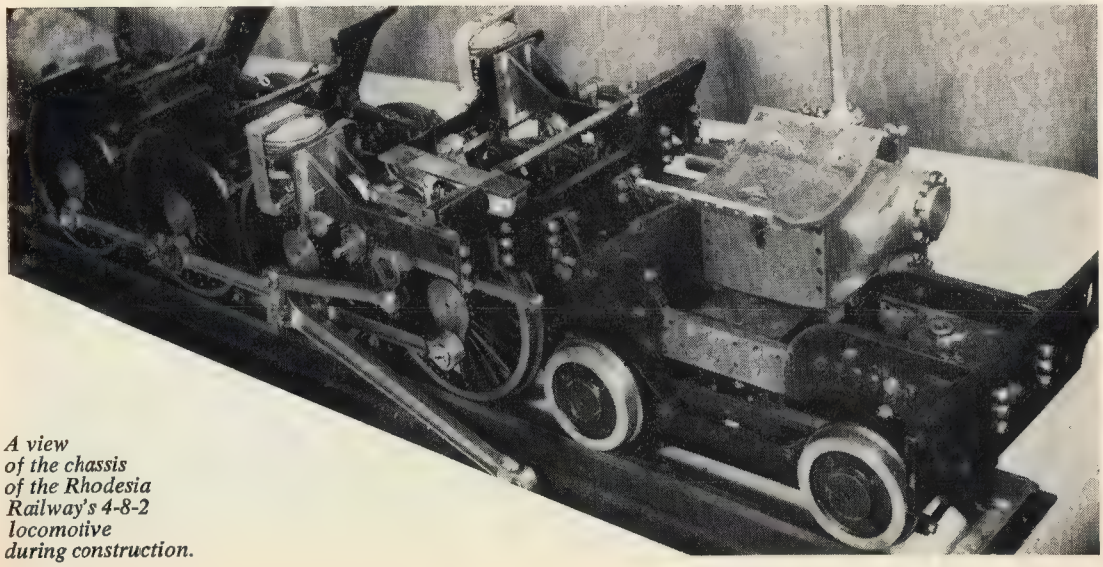


The cylinders are cast in pairs with half the saddle.

wheels, solid bronze axleboxes on drivers, scale cast iron boxes with bronze half liners and removable covers on tender and pony truck. Working leaf springs throughout engine, bogies and tender. Fully compensated springing on engine and tender. Brakes, on loco—fully compensated dual parallel system, one shoe per wheel, two steam bellows substituted for two vacuum cylinders. Tender-one cylinder per bogie, fully compensated, two shoes per wheel.

Boiler, steel all welded, firebox and tubes copper brazed and silver soldered respectively. Test pressure 250 p.s.i., working pressure 100 p.s.i. Firing by coal or propane gas. Top feed by two injectors, one each side under cab. The backhead in common with the rest of the boiler is insulated with $\frac{1}{4}$in. thick Bell's pipe cladding (used to be called "Monkey muck"), applied as a wet plaster and covered with 26 s.w.g. brass cleading.

Cab, upholstered lift up seats each side, double teak framed sliding windows and wind deflectors each side. Opening windows one each side and two above boiler in the spectacle plate. Steam turret on boiler in front of cab carries twelve near scale working valves with extension spindles



A view of the chassis of the Rhodesia Railway's 4-8-2 locomotive during construction.

into cab, plus pressure gauge water gauge and light switches. Scale lever and remote indicator for steam-oil cataract servo reversing mechanism. I took a chance with this and it worked, but it is not a real proposition for a "workhorse", it is weak and unreliable.

For that matter, the locomotive itself is not a good "workhorse", it is very powerful, but utility, ease of driving and handling on and off track have been sacrificed to scale trueness and detail. One cannot reach the cab from a driving car, the rails and ladders have to be taken off the tender and a cushion substituted. The number of controls in the cab (17 in all) is confusing, even for the builder who needs a check list. And on top of all that it is difficult to lift without damaging small external details.

The tender is built to scale down to the last bit of angle iron, rivet and bolt. Additions not on the prototype, are:— a, A bulkhead in the water tank just aft of the manhole. b, A removable end to the tank and in the space rear of the manhole there is a gas cylinder converted from an aircraft oxygen cylinder. The gas is piped to the cab via a dummy train heat pipe. c, The crew and tool lockers contain torch batteries for the headlight and cab light. At present the turbo-generator is a dummy, but I have 75 per cent finished a working one to a design of Mr. Rowbottom of Capetown, M.E., Nov., 1954.

For showcase purposes, coal is mounted in clear epoxy resin on a plywood base and can be lifted out with one hand, underneath is a raised skirted slot for the emergency pump handle. There are three water bags, two gravity feed to the injectors and one from the emergency pump.

The inner steam dome is to scale with 3¼in. O/D machined flanges and 22 5 BA studs, it is steam tight at 100lb. without a gasket. The outer dome is spun up from 20 s.w.g. aluminium. The "Alliance" automatic couplers are to scale and work. The monogram on the smokebox and on the cab and front beam were engraved by pantograph from the full size prototypes loaned to me by Rhodesia Railways.

This is my first model locomotive, but I am not a true amateur being a professional engineer, at present teaching engineering. The project took about 3,500 hours spare time, over a period of six years. Free use was made of Martin Evans' "Locomotive Valve Gears" and "Manual of Model Steam Locomotives."

It is probable that my 19th class will end up alongside Martin Evans' 20th class Garratt in the Rhodesia Railways museum in Bulawayo.

A STEAM — ELECTRIC GENERATING SET

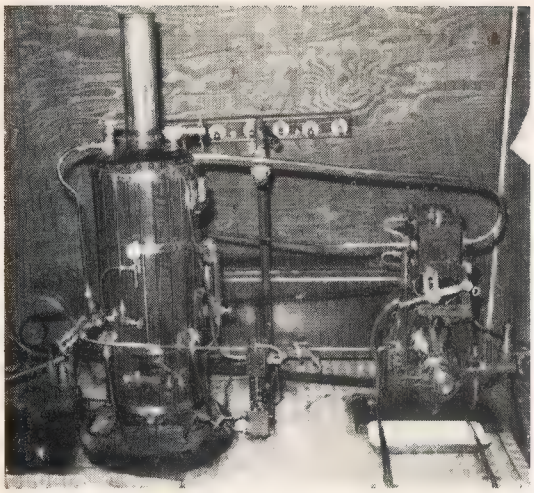
by L. Willoughby

A CHANGE is as good as a rest so they say, and so, having satisfied my appetite for locomotives and traction engines, I took the advice of the old saying and decided on a stationary steam plant which would be simpler and easier to build. This was brought about by "Anno-Domini" and a loss of power.

I considered that this model would be useful as I could amuse myself during my leisure time, of which I have plenty. It could be used to drive my various small model pumps etc., and I have quite a number. I could also use it for testing purposes; and so, having disposed of my latest creation, a 3in. scale Burrell tractor, I was in the position to purchase the necessary ingredients which consisted of copper for the boiler and a set of castings and materials for the engine. The boiler came first and this is 6in. O.D. and 18in. high and ⅛in. thick with 35 tubes ½in. dia. and superheated. Copper is used throughout and silver soldered. Boiler feed is by a "Weir" type pump and an emergency hand pump is provided.

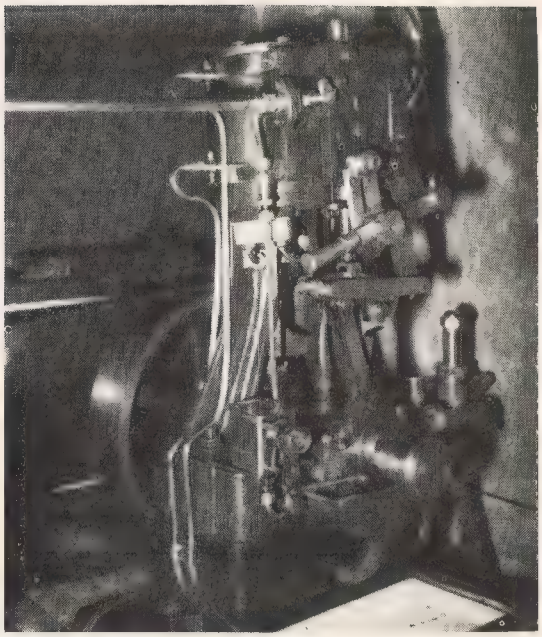
The fittings which screw into bushes silver soldered into the barrel consist of two large steam cocks, one to supply the turret and the other is the main steam cock. The remaining fittings are the usual steam turret, water gauge, clack boxes, pressure gauge, safety valves, blow down cock and washout plug. The turret is fitted in a convenient position on the side of the boiler with cocks which supply the pump, blower, and pressure gauge, with a spare cock for testing purposes and could be used for driving other models.

The boiler construction follows the usual practice and was easy because there were no stays or shaping of the barrel, the only shaping was for the tube plates and chimney plate. The cleading is wooden strips obtained from a D.I.Y. shop and are ½in. wide and ⅛in. thick with rounded corners, with asbestos underneath, held in place by brass bands, this adds considerably to the appearance. The superheater consists of the usual hot and cool headers connected by the elements which pass over the flue tubes and so tend to reduce sparks at the chimney. The foundation ring is really a ring and is narrower



The steam-electric generating set.

Right: The Stuart 5A engine.



than the water space and so the bottom of the firebox is swaged out to meet it so making for a slightly larger grate area; provision is also made for fire dropping. The whole stands in a circular tray which catches any stray water or ash and so keeps the vicinity tidy.

The pump is constructed on the principle described by LBSC many years ago and is very reliable. I have never had to revert to the hand pump, but I do find that efficient lubrication is very essential and so a mechanical lubricator is provided, with hand plunger. I cannot yet get the pump to work slowly enough to keep it working all the time that the engine is running. Having got so far I tested the boiler to 200 p.s.i., working pressure is 75 p.s.i.

Now for the engine! This is a Stuart 5A., single cylinder, 2¼in. bore, with reversing gear. At first I thought that this would be rather large for the boiler, but as I wanted an engine that would do some work I took a chance because all of my engines have had to work hard. I have fitted a mechanical lubricator and oil boxes with worsted trimmings for bearings and slide bars, the lubricator being driven from the engine pump eccentric, this pump replenishes the water tank from a drum under the bench.

Drip trays are provided under the eccentrics, bearings and pump gland to catch any waste water or oil and divert it to the sump in the engine bed and eventually to a vessel under the bench together with waste from the boiler. The result is a very clean running outfit.

The electric generator is a 6-volt motor-cycle dynamo fitted in a case made from a piece of a lawn mower roller and provided with feet for attaching to the base and driven by a flat leather belt. The result is a reasonable looking generator which will light seven small lamps and one large one, one small bulb is used to illuminate the water gauge. The water tank is rectangular and measures 27in. × 7in. × 5in. and holds 2 galls. which is ample because the engine pump continually replenishes it from a drum under the bench. I always use rain water.

I have worked the set on many occasions and still do with great satisfaction for my own and my acquaintances' entertainment and it works admirably well. Maintaining the boiler when working full out is a whole time occupation because coal and water consumption is very heavy, but this makes it all the more interesting. The boiler has very little reserve. The photographs were taken by E. Wyatte.

ERRATUM

Building the Allchin

In Part XVIII (17 May), the 9/32 in. dimension in Fig. 1D, and on page 499, should read 5/16 in., and in Fig. 1F the 7/32 in. dimension should be 17/32 in., to correspond with that on page 501.

Quick-change or Four-way toolpost?

John A. Rea discusses the good and bad points of lathe toolholders

IN VIEW of the recent correspondence on the above subject I feel perhaps it would be helpful to beginners and the like if we looked at the controversy that would seem to be arising between the two methods of holding tools in the lathe from a practical standpoint. First of all let us consider each toolpost on its good and bad points.

Quick Change Toolpost

Advantages:

1. Rapid setting of tooling to centre height after re-grind.
2. Any number of tools can be pre-set providing one has enough holders.
3. Up to 3 tools may be held in place at any one time on the toolpost ready or positioning; two if a boring tool is to be used.
4. Power drilling is possible with Morse Taper Tool Holder.

Disadvantages:

1. On the Q.C. toolpost used by the writer to date, no means of setting tools to a ratchet stop is provided and the toolpost can be slid about on the top-slide each time it is indexed or should one say repositioned, therefore no zero can be relied on for production work unless one changes toolholders for each operation, and keeps the toolpost locked.
2. The first requirement of all good turning is rigidity but the Q.C. post allows a large amount of overhang as shown in Fig. 1, I have seen the toolholder visibly lift away from its locating vees when undercutting or parting off on quite a substantial lathe due to lack of support directly under the tool. Theoretically the vertical locating vees should overcome this problem and I would imagine that this is more often than not the case. But nevertheless I have had the problems as indicated above. If we bear in mind that the limiting factor towards rigidity on most amateur lathes is likely to be size and condition of headstock bearings and overhang of work this disadvantage can for all intents and purposes be discounted, but I think it is worth considering if one has a lathe of a more industrial capacity and bearings to suit.
3. The cost of individual toolholders is high, so unless one has a deep pocket the number available is likely to be small.

Four Way Toolpost

Advantages:

1. Tool is supported directly on top-slide under toolpost as Fig. 2.
2. Many can be indexed to a ratchet stop in four positions and in some cases eight or at 45 deg. intervals.
3. Some have automatic indexing by the operation of the clamping lever, the one fitted to the Harrison 12in. lathes being excellent in this way.
4. Up to 3 tools can be held as well as a boring tool.
5. The advantage of a ratchet stop lends itself to repetition work together with a bed stop or a multi stop as on capstan lathes.

Disadvantages:

1. Packing pieces have to be used to pack tools to centre height.
2. Pre-set tooling is possible but would be difficult to maintain after regrinding.
3. No power drilling.
4. A further disadvantage is the fact that with a number of tools protruding from the post in different directions one or more of them may foul the work protrusions from the lathe and of course there is the added danger of one cutting oneself on the tool tips unless one is extremely careful. I would advise when tapping or threading in the lathe, pulling the chuck round with the chuck key, that the tools nearest the chuck be removed in order to avoid accidents should the key slip from the chuck. I have seen at least one very bad accident through an apprentice not observing this simple rule and many minor ones, I feel this rule should also apply to the Q.C. toolpost.

The use of packing in a standard four way toolpost can be kept to a minimum if one is able to manufacture or acquire a toolpost which will give a standard distance from its tooling face to lathe centre line e.g. $\frac{3}{8}$, 7/16 or $\frac{1}{2}$in. which would ensure if the tool was carefully ground it would come on centre line without packing at all. This is the method I adopt (my toolpost has only two positions, this I find no problem). Using $\frac{1}{2}$in. tools, what if you wish to ultilize $\frac{3}{8}$in. or 7/16in. or any other standard size? Well the answer is obvious, it needs packing but the packing need only be one piece of $\frac{1}{8}$in. or 1/16in. thick.

I feel possibly the greatest mistake made by

many people is that they grind the top of the tool and reduce the height, thus necessitating the use of all sorts of thicknesses of packing. One should only regrind tools, with the exception of form tools, from the front, regrinding top rake only when the tool is worn back. Obviously one can only generalise and cannot lay down strict rules because each operator will have his individual problems.

The Q.T.C. is to a degree revolutionary over the 4-way or any other tool holder on centre lathes and it has many hidden advantages which with use would soon become apparent; however, for the home workshop and for short production runs the old 4 way wants some beating.

I note that Mr. T. H. Grundy (Postbag, 15.3.74) feels it is easier to regrind the tool bit still clamped in the toolholder; a method I certainly would not advocate as one loses the sensitive control needed if grinding is to be done well. To add the bulk of a toolholder usually many times the weight of the tool itself must create many problems when presenting it to the grinding wheel.

Finally, the general trend seems to lay more emphasis on time than on the pleasure we derive from our chosen hobby. Some people no doubt are quite happy to build models as quickly as possible with little finesse. We all look forward to seeing our latest products on the track, in the air, or on the pond; however, I feel the greatest pleasure is in the building when one can progress at one's own pace without having the foreman or chargehand breathing down one's neck!

Making Small Box Spanners

by V. Hodgson

IN BUILDING models it is necessary to assemble and dismantle parts of them at least once and often several times. The nuts are usually small, and sometimes not easily accessible, so that it is tedious and time-consuming to turn them with the ordinary set spanner. Box spanners are often much easier to use for this purpose and they are kinder to the nuts; they are sometimes indispensable. It might not commonly be known how simply they can be made, but in an hour or two a set of box spanners from 2 BA to 12 BA can be made from mild steel, or if one so prefers silver steel may be used.

The female hexagon of a box spanner is easily made: One end of the spanner is drilled to a diameter slightly greater than the extreme width of the nut, to a depth a little over its height. The end is heated to forging temperature, a piece of hexagon stock of the appropriate size is quickly inserted into the hole and the end of the spanner is quickly forged to shape around it. After cooling it will be found that the female hexagon thus formed is an easy, but effective, fit over the nut. The working end of the spanner is subsequently case-hardened.

To make an 8 BA box spanner: Chuck a length of $\frac{1}{4}$in. round mild steel, centre, withdraw 3in. from the chuck, insert the back centre and knurl for $1\frac{3}{4}$in., starting $\frac{1}{2}$in. from the centred end. Drill No. 43 $\frac{1}{2}$in. deep (to clear 8 BA thread) and follow with a No. 18 drill to a depth of 3/16in. Remove the work-piece from the chuck and heat the drilled end to orange. Quickly insert a 1in. length of 8 BA hexagon rod into the No. 18 hole and, pressing this against a stop on the anvil to keep it in position, hammer the end of the spanner round the hexagon. Remove the rod and after cooling turn the outside of the spanner end to 0.220in. dia. up to the knurled portion. Face off the end carefully until the depth of the female hexagon is just sufficient to cover an 8 BA nut. Part off to $3\frac{1}{4}$in. length. If figure stamps are available the size may be marked on the top end of the spanner. Bring the end of the spanner to a bright red heat and cover it with Kasenit or other case-hardening compound. Reheat for a minute or two to bright red and quench. Repeat this treatment if you wish to do so.

If desired, spanners may be made of silver steel in the same way, with somewhat thinner walls. They should be hardened and tempered to a pale or medium straw colour. Mild steel spanners, however, will be found quite satisfactory, and a little cheaper.

It is not necessary to drill the spanners to take a tommy bar, because the knurling enables one to tighten small nuts quite sufficiently and, if necessary, the larger sizes can be tightened finally with an ordinary spanner. Some might prefer to make the box spanner about 1in. long and braze it to a 5/32in. shaft equipped with a handle, like a screwdriver. In this case the hexagon tip would be requenched from a bright red heat after brazing.

The same process may be applied to the making of square female keys, but in this case it might be desirable sometimes to use a slightly undersize square mandrel for forging and to finish the key to size by broaching or filing. This usually would be quicker and less tedious than filing or broaching the female square from a round hole.

A Birth at the Brewery!

by "Tubal Cain"

I CALLED in at the Kendal Brewery today. Not, I may add, in hopes of getting a free gill, for the Brewery no longer brews and we, like most other people, have to put with the gassy stuff that seems to have the chemical formula $K_1E_1G_1$. No. The Brewery is now the Kendal Arts and Community Centre; a maze of workshops, studios, theatres, and what not, in which every taste for "doing one's own thing" seems to be catered for—from Donizetti to Disco. Poets meet on Thursdays, birdlovers on Friday, and if you want to blow—*or* make—a basset-horn I have no doubt facilities would be available.

My goal was the Cellar Bar where (wait for it) the first exhibition of the Kendal Model Live Steamers was to be held. Now this really was something, for the club had been formed only five weeks earlier. There is a flourishing Model Aero Club and a Model Railway Society, as well as an Engineering Society in the town, but for some reason Model Engineering has been missing, so far as any organised activity is concerned. This has now been put right, and if the energy and enthusiasm which resulted in an exhibition so soon after formation is anything to go by, more will be heard from the new body. (They have yet to decide whether they are a "Club" or a "Society"!) But to give full credit where credit is due, the Model Aero Society gallantly supported their more earthbound colleagues and helped to fill the exhibition space.

The Club(?) is mainly concerned with "live" steam, and the exhibition reflected this interest; there were no workshop tools. W. J. Hughes will be delighted to know that there were six traction engines, ranging from an unfinished 2½in. scale engine to a ¾in. spirit fired Burrell which, the card said, had hauled a 6-year old. Locomotives displayed an equally wide range of scales, one of the smallest being a coal-fired "Atlantic" in "O" gauge. A number of 5in. gauge locos and chassis were in evidence, and a part-completed boiler in steel for a 4-coupled well-tank loco in 7¼in. gauge showed that despite the almost vertical geography of the district, some serious hauling was to be done. Possibly the piece-de-resistance of the exhibition was Mr. Page's 3½in. gauge "Precedent" which will, I understand, be seen at the forthcoming Model Engineer Exhibition. Regrettably, I have to report two cheese-headed screws, holding in place the chimney of an otherwise very nicely made ¾in. scale narrow-gauge tank engine; otherwise such solecisms were rare.

In the stationary engine field, my greatest interest lay in the fact that the running models were all being steamed! A small vertical fire-tube boiler—of, I should say, considerable age—was sited just outside a suitably placed window and fed the engines on the running-bench just inside. I am glad to say that the boiler was coal-fired, though the feed-pump would hardly have met with the approbation of the late LBSC—it was a war-time stirrup-pump! The range of sizes of the stationary models was also large. Being the "Gateway to the Lakes" it is to be understood that there is a keen interest in steam propelled passenger boats, and one member showed a twin engine based on the Stuart No. 5a intended for use in a small launch. There were two pleasing "vintage" horizontal engines—it is difficult to understand why banded wood lagging is so attractive, but it seems to add character to an engine, as well as being a most efficient heat insulator. Similar lagging was used on a large vertical steam raising plant, complete with hot-well, coal-bunker and steam driven feed-pump. (Why not an injector? The maker said he "likes to see things working"). There were a number of the ubiquitous 1OV type engines (including one with the Tubal Cain Fan) but the smallest and not the least attractive was a tiny feed-pump a little over an inch high.

I must say a word about the aeroplane models, even though I am not competent to express any opinions on their merits. That they fly I know well, for I have seen them frequently performing amazing evolutions under radio control. That they are realistic is attested by the fact that at their annual display at the County Show many of the spectators (including myself, on the first occasion I saw them) believed them to be full-size—though at a much greater height than they actually were! My attention and interest was taken by a fine model of a first-world-war fighter which was, as it were, presiding over the main display table; I remember vividly the forced landing of just such a machine in the field behind our house when I was a small child, and was the envy of my schoolmates at having actually had tea with the pilot! A superb flying boat, 10ft. if not more of wing-span, with a 10cc engine was also an eye-catcher. I could have wished to have had time to have had a chat with some of the makers of these remarkable models,

Continued on page 722

The Editor welcomes letters for these columns. He will give a Book Voucher for £1.50 for the letter which, in his opinion, is the most interesting published in each issue. Pictures, especially of models, are also welcomed. Letters may be condensed or edited.

Wheel standards

Sir,—With reference to your observations in "Smoke Rings" (M.E. 7-20/6/74) regarding the "old Greenly era" and 5in. gauge wheel standards, I must point out that the late H. Greenly had settled on 4 11/16in. for the back-to-back dimension and 9/16in. thickness (see "Model Steam Locomotives") for many years. Here it would seem that he and L.B.S.C. were in agreement for once!

I agree that further coarsening of standard wheel dimensions is undesirable and I am puzzled as to how the matter could have arisen since in all my contacts with model engineers in Australia—and New Zealand for that matter—the question of standards has never arisen.

Whatever he may have "standardised" in the smaller gauges (0, 1, or 2½in.), in regard to 5-in. rail-gauge limits Greenly usually recommended minus 0 and plus 1/32in. on the straight and for curves a maximum of + 3/32in. Excessive reduction in the back-to-back dimension can lead to difficulties in running over points and crossings. Thus check rails would be unable to fulfil their proper function in preventing a wheel gliding away on the wrong side of the frog!

It is indeed astonishing that this matter of wheel standards should be raised at this late hour when there must be many hundreds of locomotives running satisfactorily on 5in. track the world over.

Teignmouth. E. A. Steel

Wheel Standards

Sir,—With regard to your comments about wheel standards in "Smoke Rings" of 7-20 June you say the scale thickness of wheels for 5in. gauge is ½in. to 17/32in., but you do not say to what scale you refer. Is it ¾in., 1in., 1 1/16in. to the foot? If one was to model a 15in. gauge industrial locomotive on 5in. gauge it would be 1/3 full size and have wheels 1¼in. wide.

As narrow gauge modelling enjoys more club interest in Australia than here this could possibly be the reason for this move.

The reason narrow gauge models need closer back to back and wider flanges apart from scale appearance is the increased load on wheels and flanges. As an example a ¼ full size locomotive on 5in. gauge could have an axle load approaching 1 cwt. In 7¼in. gauge the problem is even more acute with axle loads of 5 cwt. common and even half ton in some cases, which is more than some complete locomotives weigh to 1½in. scale proportions.

The 7¼in. Gauge Society is surveying wheel standards amongst its membership and it would be worth classifying 5in. gauge standards so that people visiting unfamiliar railways would know what to expect.

May I now expand on your notes in Readers' Queries concerning C.J.W.'s 39 in. x 10 in. boiler?

A copper boiler of this size would cost £200 or more for materials only, for which sum one could buy all the materials for a welded steel boiler, an arc welder, tube expander and hand grinder and still have £100 in one's pocket to say nothing of some very handy plant in the workshop. Even if one did all the plate preparation and paid a 'firm' to do the welding it would still be cheaper than copper.

Even with flanged and riveted construction, insurance companies prefer welded 'caulking' so one might just as well weld the whole thing.

I have no experience with stainless boilers and insurance companies are not very keen on them even if shielded arc welding is used. With mild steel you have very few problems in construction.

The first thing to do is obtain the correct materials. Whilst ordinary black mild steel will produce a boiler that would last years, it will pay to get boiler plate to B.S. 1501-151, then you could always get it insured and thereby satisfy the anti 'iron pot' brigades which are active in some clubs.

If steel tubes are used they should be to B.S. 3059 and the barrel can be hot finished seamless steel tube to B.S. 3601-27. This would be cheaper and better than rolling a welded plate. Steel flues for this boiler could be ¾in. O.D. x 12 or 14 s.w.g. expanded in and beaded over at the firebox end. If copper tubes are fitted, 1/16in. wall would be suitable and both ends should be beaded over.

The tube plates should be 11 or 12mm. and the 'bridge' between tubes ⅜in. all other plates can be 6.5mm (Imperial thickness boiler plate is difficult to obtain now). The welded rods should be to B.S. 639 1 and 4 grade 3, this is a low hydrogen rod for building big fillets. The preparation of the plates is all important but not difficult to do with the hand grinder.

Perhaps the editor could persuade a contributor to write an article on this rather extensive subject.

Finally the firebox must be fitted with at least one fusible plug, not to do so is, in my opinion, a lunacy that defies description.

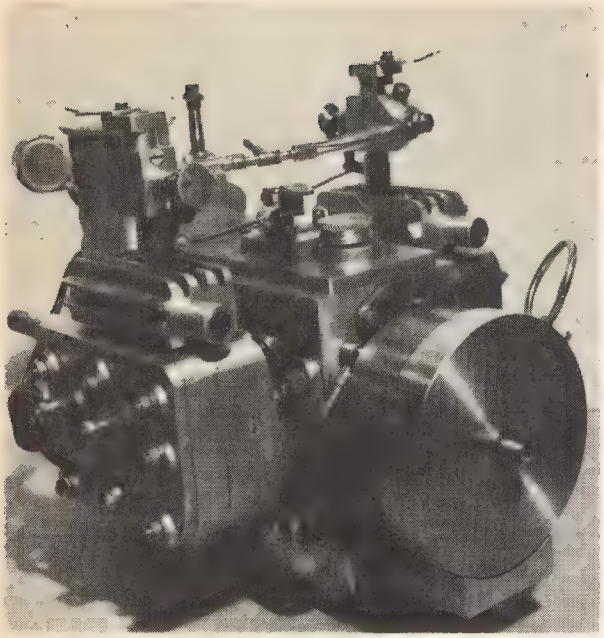
Hinckley. O.I.P.

"Mastiff"

Sir,—It is not very often that thanks are expressed to contributors of *Model Engineer*, so may I now say thank you to Len Mason for his article on *Mastiff* and previous articles on spark plug manufacture. Having previously made two-troke glow plug engines from 1½ to 10 c.c., *Mastiff* appeared to me to be a challenge. So off to a supplier of castings at Trowbridge. The castings duly arrived on the Friday before Christmas Day and work started.

The engine was finished on the day after the last instalment on *Mastiff*. A series of bangs and pops were a very welcome sound on the third pull on the recoil starter (hence the peculiar ring on the flywheel end of the engine).

Now, after two hours of running, the engine sings like a sewing machine and has surpassed all my expectations. The Araldite spark plugs which are threaded ¼in. x 32 T.P.I. are really remarkable in their performance. Being a little sceptical I made 12 in case of accidents—I have not tried the other eight yet.



Mr. F. C. Pearce's "Mastiff".

The only modification I have made to Mastiff has been the pistons which I turned from Dural with two rings each, again home-made.

Thank you Len, I have enjoyed every moment in making and running this engine. Has anyone any ideas on supression for Radio Control in a boat?

Swindon, Wilts. F. C. Pearce.

Why Superheaters?

Sir,—Mr. Cousins of Northolt in "Postbag", says a "saturated" locomotive is satisfactory, and superheaters a problem, easily blocked, etc.

But has anyone tried to build a little locomotive or traction engine with "Sinuflo" tubes—which have waves in their length, to get more out of the hot gases and avoid the weld for a superheater, in many full size installations.

They used to be "Patent" and the makers were Cochran & Co., Annan, Scotland; they may not be still under legal protection and may not be made small enough to go into the boiler of a five inch gauge engine, but enquiry of the firm named (London Office, Tavistock House East, Woburn Walk, London WC1), would clear up these points, and in the case of a big engine, a 9½in. gauge one on a public track or in the grounds of a mansion, a small industrial size of these tubes, say 1¼in. bore, would be easily applied, and they ought to be readily applied to traction engines to increase their power by a considerable amount; has anyone looked into this possibility?

The makers of these tubes supplied a special brush for the rapid and easy cleaning, but how small the smallest size is I do not know, but they might be very useful in some cases.

Then Mr. Cousins writes that he used 7/16in. dia. tubes, but the lower rows soon get blocked; it is logical to make the lower tubes larger to compensate for this tendency and it may be that a boiler could be made with tubes 7/16in. diameter at the firebox end and 9/16in. diameter at smokebox end, again, an experiment somebody might try.

Mill Hill, London. H. H. Nicholls

Indexing and Gas Turbines

Sir,—I owe Mr. F. Butler an apology. As the discussion started on simple direct indexing I allowed myself to follow this train of thought without noticing that his table refers to the use of a dividing head with a 40 to 1 ratio. There is therefore no difference between us but the result of using the 37-49 combination for direct dividing is decidedly interesting.

Because the work must make 40 revolutions before all the 127 teeth are cut the error does accumulate with each tooth cut but is distributed cyclically around the gear. The maximum tooth to tooth error is 1 in 1051 and occurs between every other tooth pair, alternatively plus and minus. In addition there is a cyclic pitch error with three maxima and three minima per revolution. Most interesting but of little concern to the average model engineer since either would give reasonably accurate results.

Actually with equipment such as that shown in the photographs accompanying Mr Butler's letter there should be little problem in dividing at all regardless of whether differential or compound methods are used. But the whole point in my original article was to show that with very simple equipment indeed and which we all have at our command very tolerable results can be obtained.

In this connection I should like to refer to Mr A. Mackintosh's article in M.E. March 2, 1973, p.245 and about which he has corresponded with me privately and to endorse his experience that a strip of metal with regular graduations upon it, steel tape, band-saw blade, perforated zinc or whatever, wrapped round a wooden drum turned to size gives extraordinarily accurate results. There is no reason therefore to wrap angular dividing in mysticism nor to believe that it cannot be attempted without a lot of expensive equipment.

I thank Messrs. Douglas, Roberts and Yates for their interest in my Gas Turbine experiments. I should be happy to correspond with them, or any other reader who was genuinely interested in this subject, privately through the *Model Engineer* office but I hesitate to incur the wrath of Mr. Clennell and his fellow model Traction Engineers by using precious space in these pages to describe a model which does not work if it were to the detriment of yet more serials on Traction Engines and Locomotives. Vox populi, vox dei and you Mr. Editor must decide.

Incidentally it has always fascinated me as to whether any readers really take their current copy of *Model Engineer* into the workshop before they can "chuck a length of 3/16in. stainless steel rod, turn down for 5/32in. length to .110 dia. and screw 6 BA; part off at 2 5/16in. overall" because we are wasting an awful lot of space if they don't.

Quorn, Leics. D. H. Chaddock.

Hand Drills

Sir,—I believe that the following may prove helpful to Mr. Vokes in connection with the inaccuracy of the chuck fitted to the hand drill he has purchased (Issue No. 3489; page 488).

The style of chuck almost always fitted to these tools used to be known in the trade as Goodell,

Millers Falls, or Star pattern, after the original American toolmakers of hand and breast drills. With the jaws actuated by springs, they appeared under the class "unguided jaw pattern" in an early (1953) issue of the British Standard covering lathe and drill chucks, one of the tests for accuracy being as follows: with test bars of two differing diameters the total dial indicator reading (eccentricity x 2) was not to exceed .005" with a reading taken 1in. from outer face of jaws. There were progressive allowances for further readings taken at increased distance from jaws, to check what is sometimes known as "dog legging".

Many, the writer included, would view this test as somewhat exacting for this style of chuck, particularly as the comparable test for drill chucks with guided jaws (Jacobs pattern) was only .001in. closer on the first test, although considerably tighter for dog-legging.

Even so, it seemed illogical to discover one year later when BSI issued their Standard for Hand and Breast Drills, and especially when recognising their commendable tendency to cross-reference new Standards to relevant parts of existing Standards, to find they were now quoting chuck inaccuracy at four times the earlier amount, .020in., which is as unnecessarily coarse as the earlier limit was fine. I recollect pointing this out to the committee secretary concerned with this Standard at the draft stage; he agreed but said he had been obliged to capitulate to pressure from hand tool manufacturers, not surprisingly well represented on the committee.

I consider that Mr. Vokes is perfectly justified in the action he has taken; this hand drill would certainly not satisfy me; there is too much careless workmanship about in the hand tool trade, even by famous makers. I suggest that .010in. TIR for the chuck's centring, including possible errors on the chuck's spindle, is not too exacting for a manufacturer to attain.

London W7 F. SEWARD

Seneca Falls Lathe

Sir,—I was extremely interested to read the enquiry regarding these lathes from D. C. F. Royle of Leicester (7.6.74 p. 539) and possibly I may be in a position to throw some light on this matter, although unfortunately I cannot hold out any hope of him being able to obtain any spare parts to-day.

The No. 10 lathe he mentions was one of The Seneca Falls Mfg. Co's. (established in 1879), line of "Star" lathes. Three sizes of these lathes were built, the rated swing over the bed being 9in., 11in. and 13in. The actual swing being one inch more on each size of lathe. His lathe is the 9in. model with 4ft. bed. All sizes could be driven from an overhead and the two smaller lathes could be had arranged for foot power by means of a treadle.

As a matter of interest it might be mentioned that the Company also built a line of Quick Change Toolroom Lathes. The rated capacity of these were 12in., 14in. and 16in., the actual swing again being one inch more in each case.

Various attachments were available for the "Star" lathes including motor drive, taper, draw-in collet, square and hexagon turrets, carriage stop, automatic carriage stop, milling and gear cutting and blocks to increase centre height. They also built bench, gap bed, speed and wood turning lathes. In the later years all "Star" lathes could be supplied with quick change gear box. Shortly after the first world war they added a line of short bed lathes to their existing productions, these were known as "Short Cut" lathes and were originally made by O. R. Adams Mfg. Co., of Rochester, New York.

Mr. Royle will be unfortunate in obtaining any spares as the company was put up for auction on 17th July 1923. I was told at the time this was caused mainly through an unfortunate business deal during the war. I have a later note for 21st February 1924 saying it was merged with The Fitchburg Machine Works of Fitchburg, Mass., (established in 1864), makers of the "Lo-swing" lathe. So, from this it looks apparently as if it was not sold at the auction. After the merger the latter company was transferred to the works at Seneca Falls. The last advertisement I have for June 1927 only mentioned Star, Short Cut and Lo-swing lathes as being made. I think in the next year or so the former must have been stopped being made.

Burton, Griffiths were for many years the agents for these lathes, they are now merged with Alfred Herbert.

If Mr. Royle has any definite information that his lathe was made around 1940 I should be pleased to hear about it.

Wembley. J. H. Davis

Micrometers

SIR,—After reading Mr. G. K. Stubbs letter criticising Mr. Kirkwood's of November issue 3477 I must say after 45 years of turning and machine tool work I fully agree with Mr. Kirkwood on the use of micrometers. Perhaps he was a little harsh on Mr. Beck in the last para. of his letter, but no doubt he was very annoyed to see instructions given to learners to use a dial gauge for measuring diameters, for which it was never intended. I would not be surprised if Mr. Kirkwood does not send another letter after Mr. Beck's error in a later issue, in which he says he put the tool *above* centre to obtain a good finish.

This is definitely wrong and should not be done, the tool should be on exact centre or a few thou under but never above, the smaller the dia turned the more critical this becomes as it will rub and burnish the work instead of cutting, requiring more pressure to make it cut as it nears the centre until finally it breaks the metal off instead of facing clean past centre.

There can be scores of reasons why Mr. Beck cannot get the finish he requires which we will not go into now, but I can say that I have never had any trouble in producing the finish I want with never more than 30 to 50 thou. radius on tool point depending of course on the feed used, the larger the radius used on a small lathe the inclination to chatter will increase, so Mr. Beck write your articles but please do NOT lead beginners astray.

Lincoln. C. A. FOYSTER

First machine tool

SIR,—Regarding the article by "Tubal Cain", January 4, I should like to make the following comments.

While I heartily agree that, if the funds are available, a lathe is the first machine to purchase, I would suggest that in the case of limited "pocket money", a small bench drill be the first purchase. With such a machine and some determination a small lathe *can* be made. Many years ago, as a young apprentice, I had to reflect along these lines. The bench

drill, without makers' name but apparently an Elliot is still in constant use. The lathe—a 2½in. centres machine made entirely of bright mild steel still exists but has now been replaced by a "Super 7".

As an encouragement to any hard-up youngster I may add that my very first lathe was made of wood! It was "equipped" with a wooden face-plate and the tailstock "barrel" was a piece of 5/16 in. screwed rod working in a nut soldered to a small plate screwed to the wooden tailstock. The headstock mandrel was a piece of rod running in lignum vitae bearings and the wooden 3-step pulley was turned *in situ*. Some reasonable wood turning was done with this contraption and plenty of fun was got out of scheming it out and building it.

In my opinion, if you have tools and engineering in your blood you know it and as "Tubal Cain" states, any radical change of ideas once you have started must be very rare.

I hope that these remarks may be of some use to anyone wanting to start our hobby and perhaps having some difficulties. On the same theme, I am sure that Derek Beck must have encouraged many and I hope that his critics don't discourage him!

Vevey, Switzerland. R. REYNOLDS

Blower Vanes

SIR,—There is an old saying, "A man convinced against his will, is of the same opinion still"; and despite Mr. Chaddock's letter, February 1st, I cannot imagine forward curved blades becoming commonplace. It is a great pity that Mr. Fincham did not give rough sketches of the blowers he mentioned, as I think he may have been referring to an axial flow type, which is vastly different from the forward curving blades sketched by Mr. Chaddock.

In paragraph 5 of his letter, Mr. Chaddock switches to water; which is quite a different thing, as there is noticeable weight which greatly aids centrifugal action, much more than is the case with air. Also the action of a water scoop is rather different, as the water would be entering at the outer end of the blade, instead of the eye of the impeller as it were, and a backward curved scoop would not lift any water at all. Regarding the Pelton wheel, here again, not only is the action reversed (the water driving the runner) but power is also derived from the reaction of the reversed stream, and the relation between jet speed and bucket speed varies vastly in practice. Any change of load with corresponding variation of bucket speed takes place before the governor can act up on the jet or jets.

Turning to the diagrams accompanying the letter, the sketch of the 'Paradoxical' blower is to my mind wrongly captioned, when described as a radial flow blower, and I can only imagine it working efficiently if the blades were mounted on a sole ring to exclude the air from the centre, and the inlet supplied with air under pressure, as in the final stage of a booster. If the inlet and outlet were arranged as sketch, the scooping effect will take place at the inlet, and also I would imagine to some extent at the outlet, and a certain amount of air carried past the outlet, to cause a disturbance in the inlet, which is undesirable.

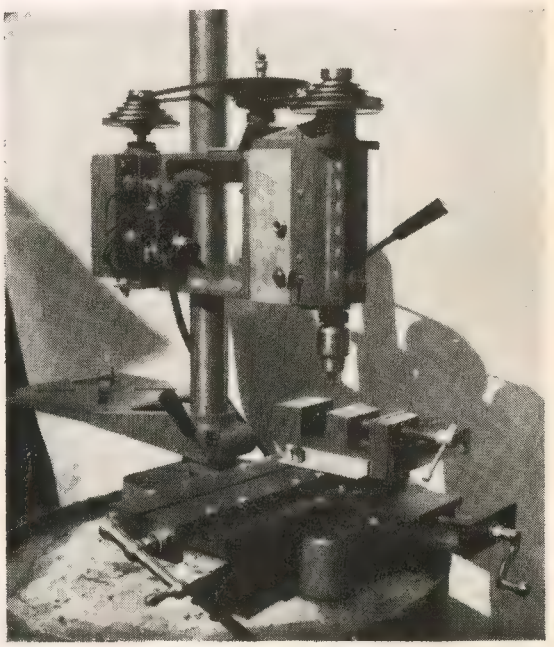
Finally, I would refer to the letter from Mr. Boddy February 15, regarding his mention of his model steam launch which went astern instead of ahead after being repaired; this reversal of direction could not accrue from just putting the propellor on the wrong way: it is far more likely that the repairers fitted another propellor of a different hand, or what is unlikely, reversed the engine's direction of rotation.

Newcastle on Tyne. E. H. JEYNES

Milling Machine

Sir,—I have been interested in the recent series of articles and letters on universal machine tools. My space is very limited, however I felt a need for a separate milling machine to liberate the lathe for tasks more suitable to it. My solution is the addition of a compound table to the drill press. I find that the two functions of drilling and milling are much more compatible in terms of change over than they were in the lathe. The drilling table can be instantly swung under the drill when needed and often enough the compound table provides an even better location for drilling. The compound table was built up from scrap steel and the longitudinal T-slot was milled in situ. The slideways were bevel cut in a jig by hand, cleaned up with a file and bolted in place. I can furnish a drawing if desired.

Oakland, Ca 94611 U.S.A. Dennis J. Nowlen



Mr. Nowlen's vertical milling machine.

Toolholders

Sir,—I apologise to Mr. Cain if he felt he had to defend himself because I happened to use the words "careless dismissal" because they really were irrevalent to what I had to say.

I think I might put another interpretation upon Q.C. yet: that of Queen's Council for the libellous statement Mr. Davis made! Joking apart, I hope that the copy of the Boxford price lists for their lathes A, B, C and AUD, BUD, CUD I have sent to Mr. Davis and have convinced him what I said was true. I would agree though, that it is unusual for such an attachment to be part of the standard

equipment with a lathe: that was why I pointed it out.

Now for the prices: I suppose I should have stated these in the first place. On all Colchester lathes apart from the Bantam and Chipmaster, Turrets are more expensive than Q.C. e.g. Student Q.C. £38.00. Turret £48.00. On Harrison lathes (11in. swing) Q.C. £41.50 Turret £47.50: this is the smallest lathe now made by Harrisons, perhaps Mr. Cain's figures referred to the old 9in. swing lathe. On Boxford lathes Mr. Cain is approximately right if you buy 6 tool blocks (although he does ignore the price of a parting tool blade and 4 H.S.S. facing and turning tools). My contention would be that by taking the standard equipment as supplied by Boxford you are only £3.50 worse off than if you got a Turret and even with 2 blocks can be made or purchased later when funds allow. What I've really been trying to get at is the implication by "Tubal Cain" in his original article that Q.C. is as useless to the model engineer as hydraulic copying or numerical control equipment would be.

Corby, Northants. T. H. Grundy

Museum

Sir,—I have just returned from a visit to Cornwall, where I discovered the Wendron Forge, a few miles from Helston.

Here is a Museum of ancient and elderly engines, including a working Cornish Beam Engine, which was earning its keep from 1850 to 1961. Also a compound Beam Engine, and what is reputed to be the oldest Portable also working, plus a Mill engine and numerous objects and engines of interest to mechanical minds.

There is also a series of open Craftsmen's Workshops, where one can see these Artists at work and even ask questions.

Entrance is free, why I will never know.

Liverpool. R. Whittenbury

Iron Rails

Sir,—Joseph Mitchell in his book "Reminiscences of My Life in the Highlands" originally published in 1883, and recently reprinted by David & Charles, mentions a Mr. Outram, engineer and manager of the Butterfly (Butterley?) Iron Works, and inventor of the iron railway which he substituted for a wooden one, previously used for conveying coal and iron.

The railway was known as a tram road, the word coming from the inventor's name. No date is given, but from other details one could suggest that the railway was made in the latter years of the eighteenth century.

Could any reader confirm this derivation of the word tram, and give the date of the manufacture of the first known iron rails?

Canonbie, Dumfriesshire. Alastair D. Cameron

Beam engine boiler

Sir,—I am most surprised by the 'Queries' answer to 'H.L.' about a suitable boiler for a 'Sanderson' Beam engine (ME No 3490). If a model B.E. will not run at *very* much less than 100 r.p.m. then something is very much wrong with either the valve gear or the workmanship or both! My Stuart and M.E. Vulcan engines will turn steadily at 20-24 r.p.m. on about 3 p.s.i. air. The Sanderson should perform equally slowly. If the cut-off is somewhat early, this can be altered to some 95% of stroke by shortening the valve itself.

The recommended boiler would give far too much steam for the Sanderson beam engine. I sincerely hope that 'H.L.' will not attempt to apply your quoted 100 p.s.i. steam to his model! It would not last long under this severe 'caning', about 5 p.s.i. is ample.

A period 'haystack' boiler wtih a cross section like a Norman doorway and semi-circular top with perhaps two simple external water tubes below will suit a beam engine. Meths. firing is adequate.

Generally speaking, a model stationary engine up to about 1¼in. cylinder, should be capable of rotating several times under human lung pressure and capacity of one breath.

Kings Lynn. Anthony Beaumont

BIRTH AT A BREWERY

From page 717

and look forward to seeing more of them on a future occasion.

I understand that it is the intention to hold further exhibitions, one in the near future, to be centred in various parts of the district—a policy that will be appreciated by the inhabitants of this area, where 4 miles "a la crow" may well be 24 by road! Anyone interested is invited to get in touch with the Secretary, Mr. M. R. Whiteside, 6 Thorney Hills, Kendal; or, just turn up at the Brewery on a Friday night and ask for the workshop.

CLUB NEWS

New Club at Royston

The latest model engineering club to be formed is the Royston & District Model Engineering Society, which already boasts 34 members. The Society meets every Monday evening at the Meridian School Workshop, Garden Walk, Royston, Herts, where members have the use of four lathes, two milling machines, two pillar drills, a foundry and forge. A number of locomotives and stationary engines are already under construction, also a portable track. New members will be most welcome, and they should contact the Secretary, Mr. W. Shaw, 109, Icknield Walk, Royston, Herts.

Sussex News

An informal inaugural run on the new extension took place on March 30th. Retiring and past members of Cuckfield Urban District Council were invited by the Sussex Miniature Locomotive Society to join with them on this occasion. 24 guests, together with their wives and families enjoyed a number of runs on the track. The invitation served a two-fold purpose, firstly as an appreciation of the co-operation and help given to the Society by past members of the Council, and secondly, by coincidence, it served as a final informal "duty" by the retiring members of C.U.D.C., for March 29th was the official date for the disbandment of the Cuckfield Council. This was a very enjoyable morning held in perfect weather.

CLUB DIARY

Dates should be sent five weeks before the event. Please state venue and time.

July 19 Rochdale S.M.E.E. General Meeting. Springfield Park, Rochdale. 8 p.m.

July 19 Romford M.E.C. Track Night. Ardleigh House Community Association, 42 Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

July 19 Stockport & District S.M.E. Evening at the Track.

July 20 Cambridge & District M.E.S. Public track day at Fulbrooke Road, Cambridge. 3 p.m.

July 20 Northolt Model Railway Club. Open Day (3½ in. gauge and 5 in. gauge track — visitors' models are welcome). Refreshments. 11 a.m.

July 20 Wigan & District M.E.S. Meeting. Co-op Guild Room, Thompson Street, Whelley, Wigan. 7.15 p.m.

July 21 Guildford M.E.S. Model Traction Engine Rally. H.Q. Stoke Park. 12 a.m.

July 21 Birmingham S.M.E. Visit to Illshaw Heath by members from North London S.M.E.

July 21 Kinver & West Midlands S.M.E. Kinver Club Competition (Mr. Paul Miles).

July 21 Worcester & District S.M.E. Public Running Day. Track and Clubhouse, Waverly Street, Diglis, Worcs.

July 24 Sutton Coldfield Railway Society. Layouts and Chit-Chat. Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.15 for 8.15 p.m.

July 24 Harrow & Wembley S.M.E. Track Meeting. Sports Field, B.R. Sports Pavilion, Headstone Lane. 7.45 p.m.

July 25 Hull S.M.E. Track Night at Goddard Avenue. 6.30 p.m. onwards.

July 27 Marden P.A.T. "Vintage Fun". Stationary engines, cars and stalls. Marden, Kent. 2 p.m.

July 27 Chesterfield & District M.E.S. "Syd's Day" — vice-chairman's mystery event. Hady Track. 2.30 p.m.

July 27/28 Burton-on-Trent M.E.S. M.E.S. Exhibition. The Pavilion, Meadow Road, (off the Trent Bridge), Burton-on-Trent, Steam trains operating. Light refreshments available. Saturday 2-10 p.m. Sunday 11 a.m.-9 p.m.

July 28 Malden & District S.M.E. Members and Families Day (Members only). Claygate Lane. 2.30-5.30 p.m.

July 28 Bristol S.M.E.E. Public Running Day. Ashton Court.

July 28 East Sussex M.E. Exhibition & Passenger Track at De La Warr Pavilion in conjunction with Polegate & District M.E.S. 11 a.m.-6 p.m.

July 28 Harrow & Wembley S.M.E. Grand Regatta — S.R. S.P. Victoria Park.

July 28 East Sussex M.E. Exhibition and Passenger Track at De La Warr Pavilion, Bexhill-on-Sea.

July 29 Stafford & District M.E.S. Talk on "Brazing" by Mr. S. Crosby. New Inn, Stafford. 7.30 p.m.

July 29 Willesden & West London S.M.E. Club Business & Bring and Buy Night. Kings Hall Community Centre, Kings Road, Willesden, NW10. 8 p.m.

July 30 Sutton Coldfield & North Birmingham M.E.S. "Boilers and their Construction". A General Discussion. Co-operative Meeting Room, 286 Brookvale Road, Erdington, Birmingham 23: 7.30 p.m.

July 31 Cannock Chase M.E.S. Bits and Pieces. Lee Hall Club, Sandy Lane, Rugeley.

July 31 Sutton Coldfield Railway Society. Railway Quiz. Wylde Green Library, Emscote Drive, Little Green Lanes, off Birmingham Road, Sutton Coldfield. 7.15 for 8.15 p.m.

July 31 Swansea S.M.E.E. Track construction evening. Club H.Q., Heol-Y-Gors, Cwmbwrla, Swansea. 7.30 p.m.

August 1 Hull S.M.E. Talk by K. Nicklas. Trades & Labour Club, Beverley Road, Hull. (Room 3.) 7.45 p.m.

August 1 Leyland, Preston & District S.M.E. Meeting. "Roebuck Hotel", Leyland Cross, Leyland, Lancs. 8 p.m.

August 2 Lincoln M.E.S. Club Night. Unitarian Chapel, High Street, Lincoln. 7.30 p.m.

August 2 Rochdale S.M.E.E. General Meeting. Lea Hall, Smith Street, Rochdale. 8 p.m.

August 2 Romford M.E.C. Competition Night. Ardleigh House Community Association, 42 Ardleigh Green Road, Hornchurch, Essex. 8 p.m.

August 2 Stockport & District S.M.E. Bits and Pieces. 8 p.m.

August 3 Ickenham & District S.M.E. 5 in. x 3½ in. g. ground level track open to Public. H.Q., rear of Coach & Horses, Ickenham Village, Middlesex. 2-6 p.m.

August 3 The M.E.S. Northern Ireland. Trackside Meeting. Ulster Folk Museum, Cultra, Co. Down.

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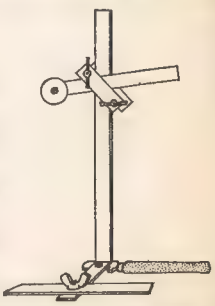

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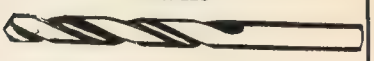

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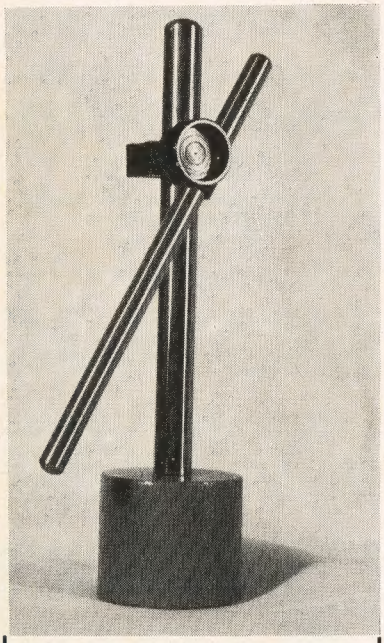

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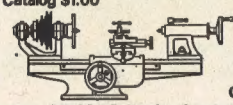

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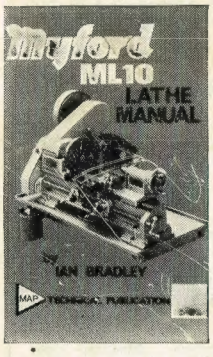

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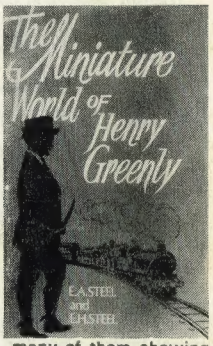

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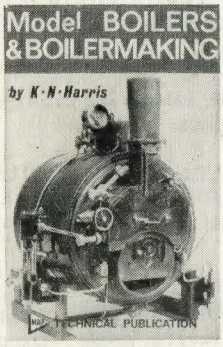

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